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DSTO-TN-0321

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**Air Operations Division**
**Aeronautical and Maritime Research Laboratory**

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## ABSTRACT

The data acquisition system in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory was recently upgraded. Several software packages were developed using C, X/Motif, and OpenGL programming languages and libraries. The software provides wind tunnel operators with graphical user interfaces from which test data can be easily monitored, acquired and processed. Descriptions of all software source code functions have been compiled and included as Appendices in this document. These function summaries have also been published on the Defence Science and Technology Organisation Intranet for easy reference for future software development.

## RELEASE LIMITATION

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# Software Function Summaries for the Low Speed Wind Tunnel Data Acquisition System

## Executive Summary

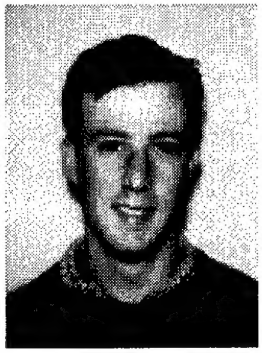
The data acquisition system in the Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL) was recently upgraded. The new system consists of a Digital AlphaServer 400 as the host computer with communication to several PC-based and VME-based slave instrumentation modules. VME-based modules were connected serially to a PC and communication to all PC-based modules was achieved using Ethernet standard.

In this environment, several software packages were developed using C, X/Motif, and OpenGL programming languages. This software included the data communication process and several applications to assist the operators in the configuration of wind tunnel tests, monitoring of parameters, and the acquisition and reduction of test data.

Descriptions of all these applications' source-code functions have been written and are documented in this report. This compilation serves as a basis and as a useful reference guide for future software development in the LSWT. The function summaries have also been published on the Defence Science and Technology Organisation (DSTO) Intranet at the following URL location:

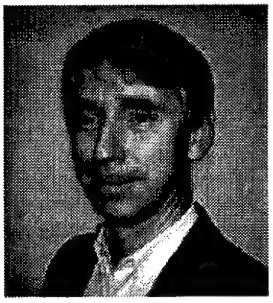
http://bernoulli.dsto.defence.gov.au/data_acq/Software/Files/Index.html

# Authors



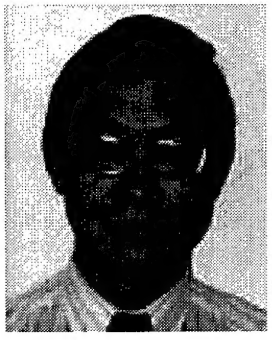

## Craig D. Edwards
Air Operations Division


*Craig graduated from the University of Queensland in 1995 completing a Bachelor of Mechanical and Space Engineering with First Class Honours. The following year he obtained employment with the Aeronautical and Maritime Research Laboratory at Melbourne. Working in Flight Mechanics, he has gained considerable experience in the area of wind tunnels and experimental aerodynamics. This has included test programmes with the Hydrographic Ship and PC-9/A aircraft in the Low Speed Wind Tunnel, and contributions to the F-111/AGM-142 store clearance project in the Transonic Wind Tunnel. He has also been involved extensively in the development of wind tunnel data acquisition systems.*




## Owen F. Holland
Air Operations Division


*Owen Holland graduated from Bendigo College of Advanced Education in 1977 with a Diploma of Electronic Engineering and then obtained a Bachelor of Engineering (Electronic) from Royal Melbourne Institute of Technology in 1983. In 1996 he was awarded a Master of Engineering in Electrical and Electronic Engineering from Victoria University of Technology. He commenced employment at the Aeronautical Research Laboratory in 1978. Since then he has worked in a number of areas including instrumentation and data acquisition systems for wind tunnels. He is currently a Senior Professional Officer in the Air Operations Division at the Aeronautical and Maritime Research Laboratory.*




## Stephen S. W. Lam
Air Operations Division


*Dr Stephen Lam graduated as a Bachelor of Engineer (Mechanical) in 1979 and obtained a degree of Master of Engineering Science in 1982 from the University of Melbourne. He later undertook a research study on Natural Convection in Trapezoidal Cavities at Monash University and was awarded the degree of Doctor of Philosophy in 1990. Dr Lam joined DSTO in 1988 and has since been working in the area of wind tunnel research. He has implemented a machine to calibrate wind tunnel strain gauge balances, and took a leading role in the implementation of a new data acquisition system for both the Low Speed and Transonic Wind Tunnels at AMRL. Dr Lam is now actively involved in the implementation of advanced aerodynamic testing techniques, and is investigating the application of Pressure Sensitive Paint measurement technique in both the transonic and low speed flow regimes.*

## Sunny Y. F. Leung

Air Operations Division

*Sunny Leung completed his Bachelor of Engineering in Aerospace Engeering and Bachelor of Business in Business Administration with First Class Honours at RMIT in 1998, and joined the Aeronautical and Maritime Research Laboratory at Fishermans Bend the following year. He worked in the Flight Mechanics area of the Air Operations Division, and was involved with experimental aerodynamics and wind tunnel test techniques. He also worked extensively in the investigation of strain gauge balance calibration matrix mathematical models.*

## Yoel Y. Link

Air Operations Division

*Yoel Link completed his Bachelor of Science in 1987 and his Bachelor of Engineering in Aeronautical Engineering in 1989, both at Sydney University, and he joined the Aeronautical Research Laboratory at Melbourne the following year. He completed a Master of Business Administration in Technology Management in 1995 at Monash University. He has predominantly worked in Flight Mechanics and experimental aerodynamics in the Wind Tunnels. During this period he has accumulated extensive experience in aerodynamics with the F-111, AGM-142, Jindivik, Tonic, PC-9, Mk82, Amphibious Transport (LPA) ship, and the Hydrographic Ship wind tunnel test programmes. He has also been responsible for the development of the wind tunnel data acquisition systems, and is currently responsible for the new Transonic Wind Tunnel, which was completed in March 2000.*

## Robert Toffoletto

Air Operations Division

*Robert Toffoletto graduated from the Royal Melbourne Institute of Technology in 1986 having obtained an Aeronautical Engineering degree. Since commencing employment at the then Aeronautical Research Laboratory in 1987, he has been involved with the aerodynamic modelling of a number of helicopters using a comprehensive rotorcraft analysis code and has used an aerodynamic panel code to develop a model of the F/A-18 aircraft and the PC-9/A trainer. He has also conducted a number of wind-tunnel tests including an investigation of the boundary layer around an array of hydrophones, flow visualisation about a PC-9/A wind tunnel model, and calibration of a rake of pressure probes.*

# Contents

# 1. Introduction

The data acquisition system in the Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL) was recently upgraded (Holland *et al*, 1999). The new system consists of a Digital AlphaServer 400 as the host computer which provided a C, X/Motif, and OpenGL software development environment. Communication to PC-based slave instrumentation modules was achieved using 10 Megabit per second Ethernet standard. VME-based instrumentation modules were connected via RS-232 serial to a PC, which was also on the ethernet network (Spataro and Kent, 1998).

The system implemented has provided fast and reliable data communication between the host computer and the instrumentation modules. Software was developed in C programming language using the User Datagram Protocol (UDP) to enable data packet sending and receiving between the host computer and instrumentation modules. Currently, VXI communication is being explored as a potential replacement for the VME-based instrumentation modules and software has also been developed for this purpose.

Several software packages including DATAIN, COMFRC (Edwards *et al*, to be published), MONFRC (Edwards, 1999), CALIB (Leung and Link, 1999), and ACTUATOR (Toffoletto, 1999), have also been developed in C and X/Motif languages. These packages assist users in the configuration of wind tunnel tests, monitoring of parameters, and the acquisition and reduction of test data. The algorithms of DATAIN, COMFRC and MONFRC were all based on the original Fortran software developed on the old host computer (Fairlie, 1985).

The source code written for the applications above is located on the LSWT host computer denoted as "Bernoulli", and descriptions of all functions are documented in this report. The function summaries are also located on the Defence Science and Technology Organisation (DSTO) Intranet at the following URL location:

http://bernoulli.dsto.defence.gov.au/data_acq/Software/Files/Index.html.

# 2. Software Description

The concept of the data acquisition system in the LSWT is illustrated in Figure 1. The Digital AlphaServer host computer is connected via a 16-port ethernet hub to PC-based instrumentation modules, which are connected directly to the ethernet using standard network cards. A multi-port serial hub PC acts as the gateway to the VME-based modules by processing ethernet requests and converting then to serial requests.

Each instrumentation module performs a particular function as part of the overall data acquisition system and is connected to its own sensors, motors, controllers, and instrumentation using a range of hardware.

All of the software described in this report resides on the host computer.

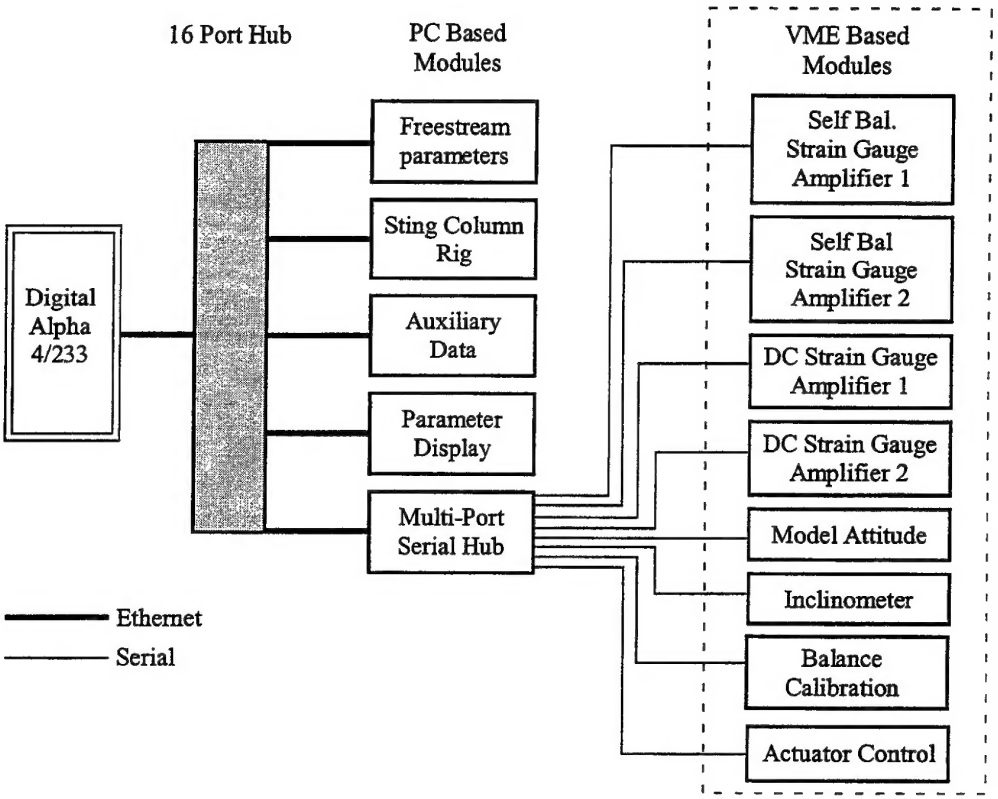



*Figure 1. Data acquisition and instrumentation conceptual layout*

## 2.1 DATAIN

DATAIN is the startup graphical interface from which wind tunnel operators can launch applications in a job specific area. On-line or Off-line wind tunnel tests (COMFRC) can be started, actuators can be calibrated and/or controlled (ACTUATOR), configuration data can be entered using WTSETUP (Edwards, 1999) and low-level data communication testing can be performed. DATAIN function summaries are listed in Appendix A.

## 2.2 COMFRC

COMFRC (Edwards *et al,* to be published) is the primary software for the acquisition and reduction of wind tunnel test data to a form required by the test engineer. It consists of a graphical user interface from which an operator can follow a test schedule and take data accordingly. Aerodynamic coefficients are calculated in real time and are displayed on the screen when data is acquired. Wind tunnel data from previous tests may also be re-processed and displayed *off-line* using this program. It is also capable of reprocessing wind tunnel data obtained from the ASE2000 system in the Transonic Wind Tunnel (TWT). COMFRC uses the UDP communication libraries to acquire the latest data from all of the instrumentation modules. COMFRC function summaries are listed in Appendix B.

## 2.3 MONFRC

Wind tunnel parameters and data can be displayed graphically in real time using MONFRC (Edwards, 1999). This software is written in C with OpenGL libraries to provide a user-friendly aesthetic interface. Due to the graphics card requirements, MONFRC can only be displayed on the LSWT host computer console screen. MONFRC uses the UDP communication libraries to acquire the latest data from all of the instrumentation modules. MONFRC function summaries are listed in Appendix C.

## 2.4 CALIB

CALIB is a software package developed in C and X/Motif and it is used to produce the calibration matrix for a force and moment strain gauge balance. The user can choose from three different calibration models and several different order calibration equations. Different methods of least squares fitting, data optimisation and statistical analysis can also be chosen. CALIB function summaries are listed in Appendix D.

## 2.5 ACTUATOR

Many wind tunnel models include control surfaces that can be remotely moved and controlled using actuators. The software ACTUATOR (Toffoletto, 1999) enables wind tunnel operators to control and calibrate these actuators via a graphical user interface. ACTUATOR uses the UDP communication libraries to acquire data from the actuator

module and also to send commands to the actuator module. ACTUATOR function summaries are listed in Appendix E.

### 2.6 UDP Communication

This library of functions enables UDP data packets to be constructed and sent from the host computer to the instrumentation modules or vice-versa. A shared memory model on the host computer was used as the interprocess communication to enable multiple software programs to access the most current data. UDP communication library function summaries are listed in Appendix F.

### 2.7 VXI Communication

This library of functions enables TCP/IP data packets to be received from the VXI controller PC by the LSWT host computer, and places them in a shared memory area providing other software programs with access to the data. VXI communication library function summaries are listed in Appendix G.

## 3. Outline of the Function Summaries

The function summaries for all software packages described in Section 2 are listed in the Appendices. They are intended as a reference and as a guide for future software developers of the LSWT data acquisition system. Each function summary has the following format:

| *FUNCTION* | **function_name** | |
|---|---|---|
| *PURPOSE* | A brief description of the purpose of the function | |
| *SYNTAX* | `type function_name(type argument)` | |
| | `List of the function arguments and their types` | Brief descriptions of the function arguments |
| | ... | ... |
| *INCLUDES* | `List of "#include" files required for the function's compilation and operation.` | |
| *RETURN VALUES* | A list of the possible return values of the function and their significance. | |
| *DESCRIPTION* | A detailed description of what the function does, the context, what other functions are called within the function, and the significance of any return values. | |

Please note that the following conditions apply to the format of the function summaries in the Appendices:

1. The functions have been listed in alphabetical order within each file. The files are listed in alphabetical order for each software program.
2. Not all lines in the function summary are required and in these cases they have not been included.
3. Simple functions do not have a detailed description section if they are adequately summarised with the other information.
4. Common word abbreviations have been used in the interest of brevity.
5. Grammatical abbreviations have been used in the interest of brevity.
6. Symbols, axes systems and wind tunnel corrections that are referred to in the function summaries are defined in corresponding references.

# 4. Conclusion

Several software packages have been developed during the implementation of a new data acquisition system in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory. Descriptions of the source code functions have been written for reference and are attached as Appendices in this report. The function summaries have also been published on the Defence Science Technology Organisation Intranet and can be found at the following URL location:

http://bernoulli.dsto.defence.gov.au/data_acq/Software/Files/Index.html.

# 5. References

Edwards, C., Lam, S., Link, Y., (to be published), ***COMFRC: Data Acquisition in the AMRL Low Speed Wind Tunnel,*** DSTO Aeronautical and Maritime Research Laboratory, Australia.

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# Appendix A: DATAIN Software Functions

## A.1. DATAIN Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| ExitDatain | Exit program datain | datain.c |
| Help | "Help" call back (not implemented) | datain.c |
| PopupMessage | Pop up a warning message | datain.c |
| PutControlButtons | Place the menu pushbuttons onto the main window | datain.c |
| PutJobDirName | Put the Job Directory name as a label on the title_block widget | datain.c |
| PutHeadings | Put the LSWT logo and DATAIN program title at the top of the main window | datain.c |
| RunProgram | Execute a program in the $HOME/bin directory | datain.c |
| CreateDirDialogCB | A call back function for the CreateDirDialog dialogue box. It creates a new directory. | opendir.c |
| CreateJobDirectory | Create a new Job Directory with the proper directory structure | opendir.c |
| OpenDirDialogCB | | opendir.c |
| OpenJobDirectory | Create a new Job Directory with the proper directory structure | opendir.c |

## A.2. DATAIN Software Function Summaries

| *FUNCTION* | **ExitDatain** | |
|---|---|---|
| *PURPOSE* | Exits Datain | |
| *SYNTAX* | `void ExitDatain(Widget w, XtPointer client_data, XmPushButtonCallbackStruct *cbs);` | |
| | `Widget w;` | ID of the parent widget |
| *INCLUDES* | `#include "datain.h"` | |

| *FUNCTION* | **Help** | |
|---|---|---|
| *PURPOSE* | "Help" button callback (currently not implemented) | |
| *SYNTAX* | `void Help(Widget w, XtPointer client_data, XmPushButtonCallbackStruct *cbs);` | |
| | `Widget w;` | ID of the parent widget |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | Currently not implemented | |

| *FUNCTION* | **PopupMessage** | |
|---|---|---|
| *PURPOSE* | Pop up a warning message | |
| *SYNTAX* | `void PopupMessage(Widget w, char *message);` | |
| | `Widget w;` | ID of the parent widget |
| | `char *message;` | string containing the message |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | This is a simple function to pop up a warning message | |

| *FUNCTION* | **PutControlButtons** | |
|---|---|---|
| *PURPOSE* | Place the menu pushbuttons onto the main window | |
| *SYNTAX* | `void PutControlButtons(Widget main_w, int numpb, ControlButton *pb, char *header);` | |
| | `Widget main_w;` | the main window widget |
| | `int numpb;` | the number of pushbuttons in the set (should be limited to a maximum of 5) |
| | `ControlButton *pb;` | Pointer to an array of pushbuttons declared in the `ControlButton` structure |
| | `char *header` | Pointer to a string containing the title of the present set of pushbuttons. |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | The properties of pushbutton are declared in a structure `ControlButton:`<br>`typedef struct {`<br>`  Widget w; /* Widget ID of the pushbutton */`<br>`  char *name; /* Widget name of the pushbutton */`<br>`  char *label; /* Pushbutton Label */`<br>`  void (*callback)(); /* Pointer to the callback routine */`<br>`} ControlButton;`<br>Each set of pushbuttons are grouped into an array and passed onto the function to be placed in a single row. For this reason, maximum number of pushbuttons (to be placed comfortably in a single row) declared in a set should not be more than 5. | |

| *FUNCTION* | **PutJobDirName** | |
|---|---|---|
| *PURPOSE* | Put the Job Directory name as a label on the `title_block` widget | |
| *SYNTAX* | `void PutJobDirName(char *jobdir);` | |
| | `char *jobdir;` | string containing the name of the job directory |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | This function is called whenever the user opens a job directory. It first checks if the `jobdirname` widget exists. If it doesn't exist the function creates it, else the text value of the `jobdirname` widget is set to that of the `jobdir`. | |

| *FUNCTION* | **PutHeadings** | |
|---|---|---|
| *PURPOSE* | Put the LSWT logo and DATAIN program title at the top of the main window | |
| *SYNTAX* | `void PutHeadings(Widget main_w, Display *dpy);` | |
| | `Widget main_w;` | the main window widget |
| | `Display *dpy;` | the display context obtained by calling `dpy = XtDisplay(toplevel);` where `toplevel` is the widget returned by `XtVaAppInitialize` |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | This function puts the LSWT logo and DATAIN program title at the top of the main window. The LSWT logo is input from the image file "lswtlogo.xpm" located in the $HOME/bin directory. The DATAIN program title is hard coded in the "`#define PROG_TITLE`" statement contained in `datain.h` | |

| *FUNCTION* | **RunProgram** | |
|---|---|---|
| *PURPOSE* | Execute a program in the $HOME/bin directory | |
| *SYNTAX* | `void RunProgram(Widget w, char *prog, char *param);` | |
| | `Widget w;` | ID of the parent widget |
| | `char *prog;` | name of the program to be executed |
| | `char *param;` | command line parameters needed by the program, `NULL` if there is none |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | The program to be executed should be in the **`$HOME/bin`** directory. If the program is not found, a warning message will pop up. | |

| *FUNCTION* | **CreateDirDialogCB** | |
|---|---|---|
| *PURPOSE* | A call back function for the CreateDirDialog dialog box. It creates a new directory. | |
| *SYNTAX* | `void CreateDirDialog(widget w, int client_data, XmSelectionBoxCallbackStruct *cbs;` | |
| | `widget w` | ID of the parent widget |
| | `int client_data` | callback client data |
| | `XmSelectionBoxCallbackStruct *cbs` | callback structure information |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | Creates a job directory and the copies the `template` directory structure and files to the new the job directory if OK is pressed on the dialog box. | |

| *FUNCTION* | **CreateJobDirectory** | |
|---|---|---|
| *PURPOSE* | Create a new Job Directory with the proper directory structure | |
| *SYNTAX* | `int CreateJobDirectory(Widget w, int client_data, XmPushButtonCallbackStruct *cbs);` | |
| | `Widget w;` | ID of the parent widget |
| | `int client_data;` | Not used |
| | `XmPushButtonCallbackStruct *cbs;` | Callback data structure |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | To simplify the process of creating a proper directory structure for the wind tunnel job, a directory known as **`$HOME/task/template`** containing the basic directory structure described in OpenJobDirectory is used as a template, so that when the **`CreateJobDirectory`** function is called, it simply copies the whole template directory structure to the new job directory. Basic configuration and initialisation files may also be included in this template directory so that they too can be copied to the new job directory. | |

| *FUNCTION* | **OpenDirDialogCB** | |
|---|---|---|
| *PURPOSE* | Opens to the selected job directory | |
| *SYNTAX* | `void OpenDirDialogCB(Widget w, int client_data, XmSelectionBoxCallbackStruct *cbs);` | |
| | `Widget w;` | ID of the parent widget |
| | `int client_data;` | callback client data |
| | `XmSelectionBoxCallbackStruct *cbs;` | callback structure information |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | Changes the working directory to the selected job directory and calls the function `PutJobDirName` | |

| *FUNCTION* | **OpenJobDirectory** | |
|---|---|---|
| *PURPOSE* | Ask the user to select a Job Directory as the default working directory | |
| *SYNTAX* | `int OpenJobDirectory(Widget w, int client_data, XmPushButtonCallbackStruct *cbs);` | |
| | `Widget w;` | ID of the parent widget |
| | `int client_data;` | Not used |
| | `XmPushButtonCallbackStruct *cbs;` | Callback data structure |
| *INCLUDES* | `#include "datain.h"` | |
| *DESCRIPTION* | Most LSWT Data Acquisition Programs requires a proper directory structure before they can operate correctly. The **`OpenJobDirectory`** function is therefore necessary to be executed at the start of the **datain** program to set the default working directory to an appropriate one. All wind tunnel job sub-directories are expected to be under the **`$HOME/task`** directory. Each job directory should contain at least the following sub-directories:<br>• `conf/`<br>• `data/`<br>• `results/`<br>• `misc/`<br>• `sched/`<br><br>This function is normally executed as a pushbutton callback and hence is not expected to return any value. However, the function may be called in the normal fashion, and returns 0 for success opening of the job directory, else -1 is returned. | |

# Appendix B: COMFRC Software Functions

## B.1. COMFRC Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| calall | Recalculate all data lines using average values of initial and final zeros and print the results | calall.c |
| calalltwt | To calculate tareweight components | calall.c |
| frclsf | Calculate the least squares slope A in Y=A*X and the standard error of estimate of A, STERR | calall.c |
| momlsf | Calculate the least squares estimates of A and B in X1=A*X2 + B*X3 and the standard error of estimate, STERR | calall.c |
| attmod | Converts raw theta, psi, phi attitudes to alpha and beta and to take account of balance offsets and deflections | calcsfrc.c |
| balred | Produces balance load components from a 6 component SG balance voltage readings using a second order calibration matrix | calcsfrc.c |
| invbal | Finds the set of voltage readings R equivalent to a set of component loads F. | calcsfrc.c |
| procalcs | Calculates thrust and torque coefficients for propeller measurement tests | calcsfrc.c |
| tarewt | Calculates the tare weight contribution | calcsfrc.c |
| toaxes | Converts wind axes coefficients to body, stability and missile axes coefficients | calcsfrc.c |
| towind | Converts balance buoyant loads to body axes coefficients and then to wind axes coefficients | calcsfrc.c |

| | | |
|---|---|---|
| wtcorr | Applies wind tunnel corrections to the data | calcsfrc.c |
| CreateArrowButtons | Create 2 control buttons for Prev & Next schedule commands | comfrc.c |
| CreateDataField | Create an area for Data Line outputs | comfrc.c |
| CreateFilenameBox | Create Data File, Config File and Schedule File Name boxes | comfrc.c |
| CreateManualButtons | Create 2 control buttons for manual setpoint and move commands | comfrc.c |
| CreatePushButtons | Create an area for Data Line outputs | comfrc.c |
| CreateScheduleField | Create an area for Schedule file outputs | comfrc.c |
| exit_comfrc | Exit function of the comfrc program | comfrc.c |
| ForceUpdate | Function that forces an update of the screen and flushes all X events and requests | comfrc.c |
| fully_auto_cb | Callback function if fully auto mode is selected from the option menu | comfrc.c |
| main | Main function for Comfrc application | comfrc.c |
| man_setpt | Callback function if the manual setpoint push button is pressed | comfrc.c |
| manual_cb | Callback function if manual mode is selected from the option menu | comfrc.c |
| PopupGeneralWarningDialog | Create a pop-up general warning dialog | comfrc.c |
| PopupGeneralWarningResponse | Callback routine for the response of PopupGeneralWarningDialog() | comfrc.c |
| ProcessArgv | Processes arguments passed through input line | comfrc.c |
| ProcessKeyEvent | Function to process Keyboard commands | comfrc.c |
| semi_auto_cb | Callback function if semi auto mode is selected from the option menu | comfrc.c |

| | | |
|---|---|---|
| SetPushButtonsSensitive | Sets the initial sensitivity of the push buttons according to whether a first or final zero has been taken | comfrc.c |
| tol_cb | Callback function if "apply tolerances" checkbox is toggled | comfrc.c |
| CreateMenuBar | Create the Menu Bar, incorporating all the menu commands | comfrcmenu.c |
| file_cb | Callback function for the "File" menu command | comfrcmenu.c |
| help_cb | Callback function for the "Help" menu command | comfrcmenu.c |
| options_cb | Callback function for the "Options" menu command | comfrcmenu.c |
| tools_cb | Callback function for the "Tools" menu command | comfrcmenu.c |
| AcquireActuatorData | Reads data array from the Actuator Module | DataAcqFuncs.c |
| AcquireACStrainGauge1Data | Reads data array from the AC Strain Gauge 1 Module | DataAcqFuncs.c |
| AcquireAuxiliaryData | Reads data array from the Auxiliary Module | DataAcqFuncs.c |
| AcquireCalibrationModuleData | Reads data array from the Calibration Module | DataAcqFuncs.c |
| AcquireFreestreamData | Reads data array from the Freestream Module | DataAcqFuncs.c |
| AcquireInclinometerData | Reads data array from the Inclinometer Module | DataAcqFuncs.c |
| AcquireStingColumnRigData | Reads data array from the Sting Column Rig Module | DataAcqFuncs.c |
| AcquireTurntableData | Reads data array from the Turntable Module | DataAcqFuncs.c |
| AcquireVXIStrainGaugeData | Reads data array from the Strain Gauge Module through the VXI system | DataAcqFuncs.c |
| ConvertActuatorData | Converts a raw data array obtained from the Actuator module into engineering units and places in the current line pointer | DataAcqFuncs.c |

| | | |
|---|---|---|
| ConvertACStrainGauge1Data | Converts a raw data array obtained from the AC Strain Gauge 1 module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| ConvertAuxiliaryData | Converts a raw data array obtained from the Auxiliary module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| ConvertCalibrationModuleData | Converts a raw data array obtained from the Calibration module into engineering units and places in a data array of type double | DataAcqFuncs.c |
| ConvertFreestreamData | Converts a raw data array obtained from the Freestream module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| ConvertInclinometerData | Converts a raw data array obtained from the Inclinometer module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| ConvertStingColumnRigData | Converts a raw data array obtained from the Sting Column Rig module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| ConvertTurntableData | Converts a raw data array obtained from the Turntable module into engineering units and places in the current line pointer | DataAcqFuncs.c |
| validate_data_not_stale | Ensure that the data obtained is non-stale (i.e. a new packet) | DataAcqFuncs.c |
| validate_vxi_data_not_stale | Ensure that the data obtained is non-stale (i.e. a new packet) | DataAcqFuncs.c |
| dsp_data | Send a line of data to the serial line | display.c |
| dsp_endblock | Send the "end of block" signal | display.c |

| | | |
|---|---|---|
| dsp_init | Initialises the serial line and send the initial strings | display.c |
| dsp_open | Open the terminal line for I/O | display.c |
| dsp_reject | Send the "reject" signal | display.c |
| dsp_send | Send a character to the terminal device | display.c |
| get_act_channel | Obtain the actuator channels that controls the elevator and rudder | display.c |
| get_dbvalue | Returns the value of the variable indicated by `dbname` | display.c |
| CancelCallback | Call back routine for the Cancel push button on the `SetUpActuatorsDialog` | filedialog.c |
| CheckBoxCallback | Callback routine for the "Use different Config File" CheckBox widget | filedialog.c |
| CreateButton | Create pushbutton controls for the File Dialog | filedialog.c |
| CreateCheckBox | Establish a checkbox widget for "Using different Config File" | filedialog.c |
| CreateFileComboBox | Create File Combo Box for the File Dialog | filedialog.c |
| DataFileCallback | Callback function for DataFile combo box selection | filedialog.c |
| GetFileList | Get a list of all files from a given sub-directory | filedialog.c |
| OpenFileCancel | Callback function for the "CANCEL" button in Open File Dialog | filedialog.c |
| OpenFileDialog | Establish an Open File Dialog for comfrc | filedialog.c |
| OpenFileHelp | Callback function for the "HELP " pushbutton in Open File Dialog | filedialog.c |
| OpenFileOK | Call back routine for the "OK" pushbutton in Open File Dialog | filedialog.c |
| ResetCallback | Call back routine for the Reset push button on the `SetUpActuatorsDialog` | filedialog.c |
| SetConfigFileBox | Set the contents of the Config File Combo Box | filedialog.c |

| | | |
|---|---|---|
| SetUpActuatorsDialog | Creates a dialog to inform the user of the setup progress of the actuators | filedialog.c |
| trim_trailing_spaces | Trim off Trailing spaces from a given string | filedialog.c |
| Find_Fmt | Searches for `String` in file `fp`, then returns file pointer to original position | initfrc.c |
| FndNextLine | Reads file `fp` until the next valid line is reached. | initfrc.c |
| Find_Var | Finds a specified string within a specified file | initfrc.c |
| init | Does initialisation for wind tunnel test | initfrc.c |
| ReadCharArray | Splits a string (`Line`) into an array of sub-strings, which are separated by one or more spaces, or tabs. | initfrc.c |
| Read_Config_File | Reads all configuration data from the supplied configuration file | initfrc.c |
| Read_Old_Config_File | Reads all configuration data from the supplied configuration file (of the old format) | initfrc.c |
| ReadSchedFile | Reads the test schedule information from the specified Test Schedule file into a `SchedFilePtr` | initfrc.c |
| Read_Vector | Reads numbers from a string into a vector | initfrc.c |
| Write_Config_File | Writes configuration data in the `ConfigDataPtr` to a file | initfrc.c |
| hostZero | Writes the inclinometer offsets contained in the modules initialisation file down to the Inclinometer Module | initModules.c |
| initFs | Does initialisation of the Freestream Module | initModules.c |
| initInc | Does initialisation of the Inclinometer Module | initModules.c |
| initSCR | Does initialisation of Sting Column Rig | initModules.c |

| | | |
|---|---|---|
| initTurntable | Does initialisation of Turntable Module | initModules.c |
| selfZero | Performs a "zero" of the inclinometer | initModules.c |
| setReNoLength | Writes the Reynolds Number length down to the Freestream Module for correct calculation and display of Reynolds number | initModules.c |
| streamAllModules | Sends a streaming command to all communicable modules | initModules.c |
| input_offline | Inputs data from a raw data file | inputfrc.c |
| input_online | Acquires a line of data from the instrumentation modules | inputfrc.c |
| CheckStatus | This is the timeout procedure for the moving dialog, which continually updates the current wind tunnel parameter values and the movement status indicators. It also indicates whether current values are within tolerance of the test schedule file setpoints | mdl_cntrl.c |
| close_cb | This is the Close button callback for the moving dialog | mdl_cntrl.c |
| move_cb | This is the Move button callback for the moving dialog | mdl_cntrl.c |
| move_online | Creates a dialog on the Comfrc interface to show test schedule file parameter setpoints, current values and movement status | mdl_cntrl.c |
| stop_cb | This is the Stop button callback for the moving dialog | mdl_cntrl.c |
| wprint | Writes formatted output to text widgets | misc.c |
| average | Finds the average of the first and final zeros and calculates the buoyant zeros | normalfrc.c |
| chekit | Checks zero lines for consistency of attitude | normalfrc.c |
| convert_data | Converts one raw data line to engineering units | normalfrc.c |

| | | |
|---|---|---|
| FindFileConstIndex | Finds whether the specified file constant exists in the `ConfigDataPtr` | normalfrc.c |
| hextodec | Converts 2 word parameters to the correct integer format | normalfrc.c |
| normal | Processes a normal data line | normalfrc.c |
| printout | Outputs to the screen the current line vales computed from the raw data values | normalfrc.c |
| sgdata | Converts raw strain gauge data to a voltage | normalfrc.c |
| sortit | Determines whether a line is a zero line or a normal force data line | normalfrc.c |
| CalculateX1invX2 | Calculates the X1inv matrix and performs the matrix multiplication X1inv * X2 | offlineASE.c |
| ConvertDeflConstFormat | Converts the deflection matrix read in from the ASE2000 TWT data file to the LSWT format | offlineASE.c |
| ConvertDMatrixAxesFormat | Converts the D matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | offlineASE.c |
| ConvertTaresFormat | Converts the tares matrix read in from the ASE2000 TWT data file to the LSWT format | offlineASE.c |
| ConvertX1MatrixAxesFormat | Converts the X1 matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | offlineASE.c |
| ConvertX2MatrixAxesFormat | Converts the X2matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | offlineASE.c |
| offlineASE | Processes ASE2000 transonic wind tunnel data offline | offlineASE.c |
| offlineASEfrc | Reads and processes ASE2000 TWT force and moment data files offline | offlineASE.c |
| offlineASEtwt | Reads and processes ASE2000 TWT tareweight data offline | offlineASE.c |

| | | |
|---|---|---|
| Read_Config_ASE | Reads in the configuration data from both the ASE2000 transonic wind tunnel data file and a LSWT configuration file | offlineASE.c |
| ReadParameterMatrix | Searches for the header in the ASE2000 TWT data file and then reads in the matrix on the following lines according to the number of rows and columns specified | offlineASE.c |
| ReadParameterString | Searches for the header in the ASE2000 TWT data file and then reads in the string on the following line | offlineASE.c |
| ReadParameterValue | Searches for the header in the ASE2000 TWT data file and then reads in the value on the following line | offlineASE.c |
| comfrc_offline | Performs off-line computation of raw data for Comfrc | offlinefrc.c |
| read_dataline_offline | Reads a line of raw data knowing that it is only data. Called in the offline sampling case | offlinefrc.c |
| sample_data_offline | Performs the processing of the data in the off-line case if sampling is required. It includes statistical computations | offlinefrc.c |
| add_to_list | Allocates memory for another pointer after the last in the linked list and moves to that pointer | onlinefrc.c |
| calculate_stats | Calculates the statistical information for the samples at each data point | onlinefrc.c |
| comfrc_online | Performs on-line computation of raw data for Comfrc | onlinefrc.c |
| count | Returns the number of structures in the list pointed to by head | onlinefrc.c |
| cumulate_stats | Cumulates the statistical information for the samples at each data point | onlinefrc.c |

| | | |
|---|---|---|
| finalz_online | Acquires a final zero data line, sets the corresponding flag and reprocesses all data based on the first and final zero data | onlinefrc.c |
| find_penultimate | Returns the offset (file position) of the penultimate line of a file | onlinefrc.c |
| firstz_online | Acquires a first zero data line and sets the corresponding flag | onlinefrc.c |
| get_data_online | Acquires data from the instrumentation modules, processes it and writes the raw data to a file | onlinefrc.c |
| help_online | Brings up available help documentation (currently not implemented) | onlinefrc.c |
| history_online | Performs history plot on `dspfrc` (currently not implemented) | onlinefrc.c |
| init_block | Initialises a new block in Comfrc - resetting of flags | onlinefrc.c |
| next_online | Prepares for the next setpoint in the test schedule file | onlinefrc.c |
| normaldata_to_widget | Outputs results from `normal` to a text widget on the Comfrc application interface | onlinefrc.c |
| prev_online | Prepares for the previous setpoint in the test schedule file | onlinefrc.c |
| reject_online | Rejects the last line of data that was acquired | onlinefrc.c |
| sample_data_online | Performs the sampling and processing of the data in the on-line case. It includes statistical computations | onlinefrc.c |
| stdev | Calculates the standard deviation from the sum, the sum of the squares and the number of samples | onlinefrc.c |
| string_to_widget | Outputs a string to a text widget on the Comfrc application interface | onlinefrc.c |
| TakeDataSamples | Obtains data samples and displays a working dialog on the Comfrc interface to indicate the progress of data acquisition | onlinefrc.c |

| | | |
|---|---|---|
| write_rawdata_line | Writes a single line of acquired raw data to the raw data file | onlinefrc.c |
| prtini | Prints the header information to the results output file and statistics file (if sampling required) for a force and moment test | prtout.c |
| prtini_twt | Prints the header information to the results output file and statistics file (if sampling required) for a tareweight calculation | prtout.c |
| prtblk | Outputs a blank line to the output results file and statistics file (if sampling required) to indicate a new block | prtout.c |
| prtline | Outputs a line of processed data to the output results file according to the output format defined in the `ConfigDataPtr` | prtout.c |
| prtstdev | Outputs a line of standard deviations of certain parameters for each group of samples | prtout.c |
| AddPaddingSpaces | Adds padding spaces to space out the header items above the test schedule field | schedule.c |
| InputScheduleList | Opens the test schedule file and loads in the header items and parameter values to the test schedule field on the Comfrc interface | schedule.c |
| SetSchedulePosition | Increments the test schedule file list by the increment amount and highlights the current position | schedule.c |

## B.2. COMFRC Software Function Summaries

| *FUNCTION* | **calall** | |
|---|---|---|
| *PURPOSE* | Recalculate all data lines using average values of initial and final zeros and print the results | |
| *SYNTAX* | `int calall(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "calallfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function traverses through the linked list starting at the first data line after the first_zero line, and using the 'first' variable as the traversing pointer, all valid data lines are re-calculated.<br>1. Balance voltages are corrected for buoyant zeros<br>2. Balance loads are calculated using calibration matrices (calls `balred` function)<br>3. Aerodynamic loads calculated by removing tareweight component (calls `tarewt` function)<br>4. Calculate alpha/beta attitudes and correct for deflections (calls `attmod` function)<br>5. Converts balance buoyant loads to body then wind axes (calls `towind` function)<br>6. Applies wind tunnel corrections (calls `wtcorr` function)<br>7. Converts wind axes coefficients to body, stability and missile axes (calls `toaxes` function)<br>8. Prints dataline to output file (calls `prtline` function) | |

| *FUNCTION* | **calalltwt** | |
|---|---|---|
| *PURPOSE* | To calculate tareweight components | |
| *SYNTAX* | `int calalltwt(GlobalPtr gp)` | |
| | `GlobalPtr gp;` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "calalltwt.h"`<br>`#include "calcsfrc.h"`<br>`#include "calallfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function assumes a linear (first-order) balance calibration and hence can calculate the tare weight components (using a least squares fit) directly without iteration. However because model attitudes are generally derived from sting base values and must be corrected for sting and balance deflections, iteration is required.<br>This function traverses the linked list starting at the first data line after the first_zero data line, and using the 'first' variable as the traversing pointer, all valid data lines are re-calculated.<br>1. Calculate tare loads from present estimates<br>2. Get balance readings equivalent to these loads (calls `invbal` function)<br>3. Calculate buoyant zeros<br>4. Calculate component loads (calls `balred` function)<br>5. Calculate sums with deflection corrected attitudes<br>6. Calculate least squares fits to forces and moments and check for convergence<br>7. Iterate or output tareweight values to file | |

| FUNCTION | frclsf | |
|---|---|---|
| PURPOSE | Calculate the least squares slope A in Y=A*X and the standard error of estimate of A, STERR | |
| SYNTAX | `int frclsf(double nn, double x, double y, double xx, double yy, double xy, double *a, double *sterr)` | |
| | `double nn` | number of points |
| | `double x` | sum of x |
| | `double y` | sum of y |
| | `double xx` | sum of x*x |
| | `double yy` | sum of y*y |
| | `double xy` | sum of x*y |
| | `double *a` | slope A |
| | `double *sterr` | standard error |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "calalltwt.h"`<br>`#include "calcsfrc.h"`<br>`#include "calallfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | Calculates the least squares slope and standard error in Y= A*X using the various sums of the x and y variables | |

| *FUNCTION* | **momlsf** | |
|---|---|---|
| *PURPOSE* | Calculate the least squares estimates of A and B in X1=A*X2 + B*X3 and the standard error of estimate, STERR | |
| *SYNTAX* | `int momlsf(double nn, double x1, double x2, double x3, double x1x1, double x2x2, double x3x3, double x1x2, double x2x3, double x1x3, double *a, double *b, double *sterr)` | |
| | `double nn` | number of points |
| | `double x1` | sum of x1 |
| | `double x2` | sum of x2 |
| | `double x3` | sum of x3 |
| | `double x1x1` | sum of x1*x1 |
| | `double x2x2` | sum of x2*x2 |
| | `double x3x3` | sum of x3*x3 |
| | `double x1x2` | sum of x1*x2 |
| | `double x2x3` | sum of x2*x3 |
| | `double x1x3` | sum of x1*x3 |
| | `double *a` | slope A |
| | `double *b` | slope B |
| | `double *sterr` | standard error |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "calalltwt.h"`<br>`#include "calcsfrc.h"`<br>`#include "calallfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | Calculates the least squares estimates and standard error in X1= A*X2 + B*X3 using the various sums of the x1, x2 and x3 variables | |

| *FUNCTION* | **attmod** | |
|---|---|---|
| *PURPOSE* | Converts raw theta, psi, phi attitudes to alpha and beta and to take account of balance offsets and deflections | |
| *SYNTAX* | `int attmod(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function first calculates balance/sting deflections from balance buoyant loads and corrects for theta and phi offsets. If the turntable is the source of psi data, beta is obtained from this. Otherwise alpha and beta are calculated from the deflected attitudes. | |

| *FUNCTION* | **balred** | |
|---|---|---|
| *PURPOSE* | Produces balance load components from a 6 component SG balance voltage readings using a second order calibration matrix | |
| *SYNTAX* | `int balred(ConfigDataPtr cdp, double f[6], double r[6])` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `double f[6]` | vector of component loads |
| | `double r[6]` | vector of balance voltages |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function produces balance load components from a 6 component SG balance voltage readings using a second order calibration matrix. First order approximation to F is calculated using calibration matrix data contained in `ConfigDataPtr`. A vector of squares and cross-products of F is formed and the non-linear contribution is calculated. Approximation to F is updated and convergence is checked. | |

| *FUNCTION* | **invbal** | |
|---|---|---|
| *PURPOSE* | Finds the set of voltage readings R equivalent to a set of component loads F. | |
| *SYNTAX* | `int invbal(ConfigDataPtr cdp, double fb[6], double rb[6])` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `double fb[6]` | vector of component loads |
| | `double rb[6]` | vector of balance voltage outputs at unit excitation |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function calculates the set of voltage readings equivalent to a set of component loads. A vector of squares and cross-products of loads is formed. The non-normalised reading components are calculated using the calibration matrix data contained in the `ConfigDataPtr`. Readings are finally calculated by predividing by D (the diagonal matrix contained in the `ConfigDataPtr`). | |

| *FUNCTION* | **procalcs** | |
|---|---|---|
| *PURPOSE* | Calculates thrust and torque coefficients for propeller measurement tests | |
| *SYNTAX* | `int procalcs(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function calculates the thrust and torque coefficients and advance ratio. | |

| FUNCTION | **tarewt** | |
|---|---|---|
| PURPOSE | Calculates the tare weight contribution | |
| SYNTAX | `int tarewt(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function calculates the tareweight contribution and uses the same algorithm whether the model is rear-sting mounted or mounted via a pylon and rear spear.<br>Tareweight contribution is added to component loads using model attitudes. Conversion of units is performed depending on the form of the calibration matrix. | |

| FUNCTION | **toaxes** | |
|---|---|---|
| PURPOSE | Converts wind axes coefficients to body, stability and missile axes coefficients | |
| SYNTAX | `int toaxes(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function converts wind axes coefficients to body, stability and missile axes coefficients using the alpha and beta attitudes and psi obtained from `attmod`. | |

| *FUNCTION* | **towind** | |
|---|---|---|
| *PURPOSE* | Converts balance buoyant loads to body axes coefficients and then to wind axes coefficients | |
| *SYNTAX* | `int towind(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function first converts the balance buoyant loads to balance axes coefficients. The balance axes coefficients are converted to body axes coefficients using the offsets located in the `ConfigDataPtr`. The body axes coefficients are then converted to wind axes coefficients using the alpha and beta attitudes obtained from `attmod`. | |

| *FUNCTION* | **wtcorr** | |
|---|---|---|
| *PURPOSE* | Applies wind tunnel corrections to the data | |
| *SYNTAX* | `int wtcorr(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function applies wind tunnel corrections to the data including blockage, lift interference factors, tailplane angle and alpha corrections. Refer to:<br>Fairlie, B.D., (1985), *Algorithms for the Reduction of Wind Tunnel Data Derived from Strain Gauge Force Balances*, Aerodynamics Report 154, AR-004-017, DSTO Aeronautical Research Laboratories, Australia. | |

| *FUNCTION* | **CreateArrowButtons** | |
|---|---|---|
| *PURPOSE* | Create 2 control buttons for Prev & Next schedule commands | |
| *SYNTAX* | `void CreateArrowButtons(Widget parent, ComfrcControlButton *cb, GlobalPtr gp)` | |
| | `Widget parent` | parent widget |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `ComfrcControlButton *cb` | Structure containing information pertaining to buttons on Comfrc interface |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates the next and previous arrow buttons for the test schedule field Creates the option menu widget with manual/semi-auto/fully-auto modes of data acquisition using the test schedule. | |

| *FUNCTION* | **CreateDataField** | |
|---|---|---|
| *PURPOSE* | Create an area for Data Line outputs | |
| *SYNTAX* | `void CreateDataField (Widget parent, XWindowsWidgets *xwp, LocalDataPtr ldp, XmFontList fontlist)` | |
| | `Widget parent;` | `ID of the parent widget` |
| | `XWindowsWidgets *xwp` | Pointer to a structure containing information on specific widgets in the Comfrc interface |
| | `LocalDataPtr ldp` | Pointer to structure containing information local to Comfrc such as the filenames and sequencing of a wind tunnel run |
| | `XmFontList fontlist` | Structure of font types for text display |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates a text field for the output of acquired data lines including wind tunnel parameters and force/moment coefficients | |

| *FUNCTION* | **CreateFilenameBox** | |
|---|---|---|
| *PURPOSE* | Create Data File, Config File and Schedule File Name boxes | |
| *SYNTAX* | `void CreateFilenameBox(Widget parent, XwindowsWidgets *xwp)` | |
| | `Widget parent;` | parent widget |
| | `XwindowsWidgets *xwp` | Pointer to a structure containing information on specific widgets in the Comfrc interface |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates Data File, Configuration File and Test Schedule File name text boxes to be input by the user | |

| *FUNCTION* | **CreateManualButtons** | |
|---|---|---|
| *PURPOSE* | Create 2 control buttons for Manual Setpoint & Move commands | |
| *SYNTAX* | `void CreateManualButtons(Widget parent, ComfrcControlButton *cb, GlobalPtr gp)` | |
| | `Widget parent` | parent widget |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `ComfrcControlButton *cb` | Structure containing information pertaining to buttons on Comfrc interface |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates the manual setpoint button to allow the user to enter manual setpoints.<br>Creates a move button to allow the user to move model attitudes/actuators to the setpoint currently highlighted in the test schedule field.<br>Creates a checkbox to allow the user to apply tolerances to the test schedule file parameters for data acquisition | |

| *FUNCTION* | **CreatePushButtons** | |
|---|---|---|
| *PURPOSE* | Create comfrc command PushButton Controls | |
| *SYNTAX* | `void CreatePushButtons(ComfrcControlButton *cb, Widget parent, int nstart, int nend, int nrows, GlobalPtr gp )` | |
| | `ComfrcControlButton *cb` | structure containing information pertaining to buttons on Comfrc interface |
| | `Widget parent` | parent widget ID |
| | `int nstart` | index of first button in cb to be created |
| | `int nend` | index of last button in cb to be created |
| | `int nrows` | number of rows over which to create the push buttons |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates the push buttons listed in the structure cb according to the start and end indices passed as arguments to the function. These buttons include the Get Data/First/Final Zero/Block End etc on the Comfrc window. | |

| FUNCTION | **CreateScheduleField** | |
|---|---|---|
| PURPOSE | Create an area for Schedule file outputs | |
| SYNTAX | `void CreateScheduleField(Widget parent, GlobalPtr gp, ComfrcControlButton *cb, XmFontList fontlist)` | |
| | `Widget parent` | parent widget |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `ComfrcControlButton *cb` | Structure containing information pertaining to buttons on Comfrc interface |
| | `XmFontList fontlist` | Structure of font types for text display |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Creates a text field for the display of test schedule file information | |

| FUNCTION | **exit_comfrc** | |
|---|---|---|
| PURPOSE | Exit function of the Comfrc application | |
| SYNTAX | `void exit_comfrc(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Exits the Comfrc application. Creates warning dialog if final zeros have not been taken. Kills the Monfrc application if it is running. | |

| *FUNCTION* | **ForceUpdate** | |
|---|---|---|
| *PURPOSE* | Function that forces an update of the screen and flushes all X events and requests | |
| *SYNTAX* | `void ForceUpdate(Widget w)` | |
| | `Widget w` | ID of a widget on the window to be updated |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Forces a graphical update of the window and flushes all X requests | |

| *FUNCTION* | **fully_auto_cb** | |
|---|---|---|
| *PURPOSE* | Callback function if fully auto mode is selected from the option menu | |
| *SYNTAX* | `void fully_auto_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | If fully auto mode is selected, the test schedule mode variable is set to 2.<br>Button sensitivities are set. Processes the setpoint currently highlighted in the test schedule field (get data/block online) | |

| *FUNCTION* | **main** | |
|---|---|---|
| *PURPOSE* | Main function for Comfrc application | |
| *SYNTAX* | `void main(int argc, char **argv)` | |
| | `int argc` | number of command line arguments |
| | `char **argv` | command line arguments<br>- online/offline<br>- force/tareweight/propeller<br>-ASE2000 TWT processing |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Allocate and initialise memories for common variables<br>Setup X-Windows widgets for Comfrc graphical interface<br>Display Open File Dialog | |

| *FUNCTION* | **man_setpt** | |
|---|---|---|
| *PURPOSE* | Callback function if the manual setpoint push button is pressed | |
| *SYNTAX* | `void man_setpt(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | If manual setpoint push button is pressed, the function "move_online" is called with the manual setpoint flag set to 1. | |

| *FUNCTION* | **manual_cb** | |
|---|---|---|
| *PURPOSE* | Callback function if manual mode is selected from the option menu | |
| *SYNTAX* | `void manual_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | If manual mode is selected, the test schedule mode variable is set to 0. Button sensitivities are set. | |

| *FUNCTION* | **PopupGeneralWarningDialog** | |
|---|---|---|
| *PURPOSE* | Create a pop-up general warning dialog | |
| *SYNTAX* | `int PopupGeneralWarningDialog(Widget parent,`<br>`char *message, char *ok_label, char *cancel_label,`<br>`char *help_label,`<br>`XtAppContext app)` | |
| | `Widget parent` | parent widget ID |
| | `char *message` | message for the dialog |
| | `char *ok_label` | label for the OK button |
| | `char *cancel_label` | label for the Cancel button |
| | `char *help_label` | label for the Help button |
| | `XtAppContext app` | Comfrc application context |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Creates a general warning dialog with a specified message and custom button labels. Modal dialog such that a response must be given before dialog is destroyed. | |

| *FUNCTION* | **PopupGeneralWarningResponse** | |
|---|---|---|
| *PURPOSE* | Callback routine for the response of PopupGeneralWarningDialog() | |
| *SYNTAX* | `void PopupGeneralWarningResponse(Widget w, int *answer, XmAnyCallbackStruct *cbs)` | |
| | `Widget w` | parent widget ID |
| | `int *answer` | return answer: |
| | `XmAnyCallbackStructure *cbs` | Callback structure containing information regarding which button was pressed |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | Sets a value to an integer variable "answer"<br>1 - OK button pressed<br>2 - Cancel button pressed<br>3 - Help button pressed | |

| FUNCTION | **ProcessArgv** | |
|---|---|---|
| PURPOSE | Processes arguments passed through input line | |
| SYNTAX | `void ProcessArgv(char *arg_list, GlobalPtr gp)` | |
| | `char *arg_list` | character line of arguments |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Processes the switch arguments for Comfrc depending on what type of test is run.<br>Sets local variables: (default is online force and moment test)<br>-o offline<br>-t tareweight,<br>-p propeller run type<br>-a ASE transonic wind tunnel run data to be processed | |

| FUNCTION | **ProcessKeyEvent** | |
|---|---|---|
| PURPOSE | Function to process Keyboard commands | |
| SYNTAX | `void ProcessKeyEvent(Widget w, char *key, GlobalPtr gp,`<br>`ComfrcControlButton *cb)` | |
| | `Widget w` | parent widget |
| | `char *key` | key press character |
| | `GlobalPtr gp` | Global comfrc pointer |
| | `ComfrcControlButton *cb` | Structure containing information pertaining to buttons on Comfrc interface |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Processes keyboard commands and calls the appropriate function | |

| FUNCTION | **semi_auto_cb** | |
|---|---|---|
| PURPOSE | Callback function if semi auto mode is selected from the option menu | |
| SYNTAX | `void semi_auto_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | If semi auto mode is selected, the test schedule mode variable is set to 1<br>Button sensitivities are set. | |

| FUNCTION | **SetPushButtonsSensitive** | |
|---|---|---|
| PURPOSE | Sets the initial sensitivity of the push buttons according to whether a first or final zero has been taken | |
| SYNTAX | `void SetPushButtonsSensitive(ComfrcControlButton *cb,`<br>`Boolean got_first_zeros)` | |
| | `ComfrcControlButton *cb` | Structure containing information pertaining to buttons on Comfrc interface |
| | `Boolean got_first_zeros` | Boolean value true if first zeros have been taken |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Sets the sensitivity of the first zero button according to the Boolean value passed.<br>Sets the sensitivity of other push buttons according to whether first zeros have been taken. | |

| *FUNCTION* | **tol_cb** | |
|---|---|---|
| *PURPOSE* | Callback function if "apply tolerances" checkbox is toggled | |
| *SYNTAX* | `void tol_cb(Widget w, GlobalPtr gp, XtPointer call_data)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `XtPointer call_data` | Callback structure |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "mdl_cntrl.h"`<br>`#include "schedule.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | If apply tolerances checkbox is toggled, the flag is set to the appropriate checkbox state according to the information in the callback structure. | |

| *FUNCTION* | **CreateMenuBar** | |
|---|---|---|
| *PURPOSE* | `Create the Menu Bar, incorporating all the menu commands` | |
| *SYNTAX* | `void CreateMenuBar(Widget main_w, GlobalPtr gptr)` | |
| | `Widget main_w` | mainwindow widget ID |
| | `GlobalPtr gptr` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"` | |
| *DESCRIPTION* | Creates the menu bar and each of the pull down menus on the Comfrc application interface | |

| FUNCTION | **file_cb** | |
|---|---|---|
| PURPOSE | Callback function for the "File" menu command | |
| SYNTAX | `void file_cb(Widget w, int item_no, XmAnyCallbackStruct *cbs);` | |
| | `Widget w;` | parent widget ID |
| | `int item_no` | item number in pulldown menu |
| | `XmAnyCallbackStruct *cbs` | callback structure |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | Processes the choice made by the user from the File pulldown menu | |

| FUNCTION | **help_cb** | |
|---|---|---|
| PURPOSE | Callback function for the "Help" menu command | |
| SYNTAX | `void help_cb(Widget w, int item_no, XmAnyCallbackStruct *cbs);` | |
| | `Widget w;` | parent widget ID |
| | `int item_no` | item number in pulldown menu |
| | `XmAnyCallbackStruct *cbs` | callback structure |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | Processes the choice made by the user from the Help pulldown menu | |

| FUNCTION | **options_cb** | |
|---|---|---|
| PURPOSE | Callback function for the "Options" menu command | |
| SYNTAX | `void options_cb(Widget w, int item_no, XmAnyCallbackStruct *cbs);` | |
| | `Widget w;` | parent widget ID |
| | `int item_no` | item number in pulldown menu |
| | `XmAnyCallbackStruct *cbs` | callback structure |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | Processes the choice made by the user from the Options pulldown menu | |

| FUNCTION | **tools_cb** | |
|---|---|---|
| PURPOSE | Callback function for the "Tools" menu command | |
| SYNTAX | `void tools_cb(Widget w, int item_no, XmAnyCallbackStruct *cbs);` | |
| | `Widget w;` | parent widget ID |
| | `int item_no` | item number in pulldown menu |
| | `XmAnyCallbackStruct *cbs` | callback structure |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | Processes the choice made by the user from the Tools pulldown menu | |

| FUNCTION | **AcquireActuatorData** | |
|---|---|---|
| PURPOSE | Reads data array from the Actuator Module | |
| SYNTAX | `int AcquireActuatorData(int *data, ActDataPtr adp, int priority)` | |
| | `int *data` | array of integer data values |
| | `ActDataPtr adp` | Actuator Data pointer |
| | `int priority` | priority of data acquisition |
| INCLUDES | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | This function reads the required actuator angles values from the Actuator module into a data array. The valid actuator channels are determined from the `ActDataPtr`. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| FUNCTION | **AcquireACStrainGauge1Data** | |
|---|---|---|
| PURPOSE | Reads data array from the AC Strain Gauge 1 Module | |
| SYNTAX | `int AcquireACStrainGauge1Data(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| INCLUDES | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | This function reads the six voltage components (X, l, Y, m, Z, n) from the AC Strain Gauge 1 module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| FUNCTION | **AcquireAuxiliaryData** | |
|---|---|---|
| PURPOSE | Reads data array from the Auxiliary Module | |
| SYNTAX | `int AcquireAuxiliaryData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| INCLUDES | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | This function reads the RPS tacho reading from the Auxiliary module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| *FUNCTION* | **AcquireCalibrationModuleData** | |
|---|---|---|
| *PURPOSE* | Reads data array from the Calibration Module | |
| *SYNTAX* | `int AcquireCalibrationModuleData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| *INCLUDES* | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | This function reads 12 strain gauge voltages from the Calibration module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| *FUNCTION* | **AcquireFreestreamData** | |
|---|---|---|
| *PURPOSE* | Reads data array from the Freestream Module | |
| *SYNTAX* | `int AcquireFreestreamData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| *INCLUDES* | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | This function reads total pressure, airspeed, dynamic pressure, temperature, Mach number and Reynolds number from the Freestream module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| *FUNCTION* | **AcquireInclinometerData** | |
|---|---|---|
| *PURPOSE* | Reads data array from the Inclinometer Module | |
| *SYNTAX* | `int AcquireInclinometerData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| *INCLUDES* | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | This function reads the theta and phi values from the Inclinometer module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| FUNCTION | **AcquireStingColumnRigData** | |
|---|---|---|
| PURPOSE | Reads data array from the Sting Column Rig Module | |
| SYNTAX | `int AcquireStingColumnRigData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| INCLUDES | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | This function reads alpha, beta, theta, phi, and height offset from the Sting Column Rig module into a data array. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| FUNCTION | **AcquireTurntableData** | |
|---|---|---|
| PURPOSE | Reads data array from the Turntable Module | |
| SYNTAX | `int AcquireTurntableData(int *data, TurntableDataPtr tdp, int priority)` | |
| | `int *data` | array of integer data values |
| | `TurntableDataPtr tdp` | Turntable Data pointer |
| | `int priority` | priority of data acquisition |
| INCLUDES | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | This function reads the required turntable angle values from the Turntable module into a data array. The valid turntables are determined from the `TurntableDataPtr`. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| *FUNCTION* | **AcquireVXIStrainGaugeData** | |
|---|---|---|
| *PURPOSE* | Reads data array from the Strain Gauge Module through the VXI system | |
| *SYNTAX* | `int AcquireVXIStrainGaugeData(int *data, int priority)` | |
| | `int *data` | array of integer data values |
| | `int priority` | priority of data acquisition |
| *INCLUDES* | `#include "DataAcqFuncs.h"`<br>`#include "normalfrc.h"`<br>`#include "mDB_Indx.h"` | |
| *DESCRIPTION* | This function reads 16 strain gauge voltages from the Strain gauge module through the VXI system into a data array. The VXI system is in the developmental stages and is external to the data acquistion system currently in operation. If priority is set =1, then the data obtained from the module must be a new packet (i.e. non-stale data) | |

| *FUNCTION* | **ConvertActuatorData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Actuator module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertActuatorData(int *data, CurrentLinePtr clp, ActDataPtr adp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| | `ActDataPtr adp` | Actuator Data pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Actuator module (actuator angles according to the valid channels contained in the `ActDataPtr`) into engineering units and places the data into the `CurrentLinePtr`. | |

| *FUNCTION* | **ConvertACStrainGauge1Data** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the AC Strain Gauge 1 module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertACStrainGauge1Data(int *data, CurrentLinePtr clp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the AC Strain Gauge 1 module (six strain gauge voltage readings) into engineering units and places the data into the `CurrentLinePtr`. | |

| *FUNCTION* | **ConvertAuxiliaryData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Auxiliary module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertAuxiliaryData(int *data, CurrentLinePtr clp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Auxiliary module (RPS tacho reading) into engineering units and places the data into the `CurrentLinePtr`. | |

| *FUNCTION* | **ConvertCalibrationModuleData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Calibration module into engineering units and places in a data array of type double | |
| *SYNTAX* | `void ConvertCalibrationModuleData(int *data, double *cal_data)` | |
| | `int *data` | data array |
| | `double *cal_data` | data array |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Balance Calibration module (12 strain gauge voltage readings) into engineering units and places the data into the array `cal_data`. | |

| *FUNCTION* | **ConvertFreestreamData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Freestream module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertFreestreamData(int *data, CurrentLinePtr clp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Freestream module (total pressure, dynamic pressure, airspeed, temperature, Mach number, Reynolds number) into engineering units and places the data into the `CurrentLinePtr`. Air density is also calculated in this function using the total pressure and temperature. | |

| *FUNCTION* | **ConvertInclinometerData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Inclinometer module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertInclinometerData(int *data, CurrentLinePtr clp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Inclinometer module (theta and phi angles) into engineering units and places the data into the `CurrentLinePtr`. | |

| *FUNCTION* | **ConvertStingColumnRigData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Sting Column Rig module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertStingColumnRigData(int *data, CurrentLinePtr clp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Sting Column Rig module (alpha, beta, theta, phi, height offset) into engineering units and places the data into the `CurrentLinePtr`. | |

| *FUNCTION* | **ConvertTurntableData** | |
|---|---|---|
| *PURPOSE* | Converts a raw data array obtained from the Turntable module into engineering units and places in the current line pointer | |
| *SYNTAX* | `void ConvertTurntableData(int *data, CurrentLinePtr clp, TurntableDataPtr tdp)` | |
| | `int *data` | data array |
| | `CurrentLinePtr clp` | Current Line pointer |
| | `TurntableDataPtr tdp` | Turntable Data pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function converts the data array obtained from the Turntable module into engineering units and places the data into the `CurrentLinePtr`. Turntable offsets are obtained from the `TurntableDataPtr`. | |

| *FUNCTION* | **validate_data_not_stale** | |
|---|---|---|
| *PURPOSE* | Ensure that the data obtained is non-stale (i.e. a new packet) | |
| *SYNTAX* | `int validate_data_not_stale(int module, unsigned int *prevCountPtr)` | |
| | `int module` | Number of the module |
| | `unsigned int *prevCountPtr` | previous packet capture count |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | Checks the current packet capture number and only returns TRUE if the current packet capture number has incremented therefore signalling new data has arrived. | |

| FUNCTION | **validate_vxi_data_not_stale** | |
|---|---|---|
| PURPOSE | Ensure that the data obtained is non-stale (i.e. a new packet) | |
| SYNTAX | `int validate_vxi_data_not_stale(unsigned int *prevCountPtr)` | |
| | `unsigned int *prevCountPtr` | previous packet capture count |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | Checks the current packet capture number and only returns TRUE if the current packet capture number has incremented therefore signally the data is 'non-stale'. | |

| FUNCTION | **dsp_data** | |
|---|---|---|
| PURPOSE | Send a line of data to the serial line | |
| SYNTAX | `int dsp_data(ConfigDataPtr cdp, CurrentLinePtr clp)` | |
| | `ConfigDataPtr cdp;` | Configuration Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| DESCRIPTION | Sends a line of data containing the data block variable/constant and the aerodynamic coefficients. | |

| FUNCTION | **dsp_endblock** |
|---|---|
| PURPOSE | Send the "end of block" signal |
| SYNTAX | `int dsp_endblock(void)` |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "display.h"` |
| DESCRIPTION | Sends the "end of block" signal |

| *FUNCTION* | **dsp_init** | |
|---|---|---|
| *PURPOSE* | Initialises the serial line and send the initial strings | |
| *SYNTAX* | `int dsp_init(GlobalPtr gp)` | |
| | `GlobalPtr gp;` | Global Comfrc pointer |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| *DESCRIPTION* | Opens the serial line connection to the PC and sends strings to initialise the data block variable and constants. | |

| *FUNCTION* | **dsp_open** | |
|---|---|---|
| *PURPOSE* | Open the terminal line for I/O | |
| *SYNTAX* | `int dsp_open(char *line, enum parity parity, int baud)` | |
| | `char *line;` | name of the line for connection |
| | `enum parity parity;` | parity |
| | `int baud;` | baud rate |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| *DESCRIPTION* | Opens a connection to a PC for I/O | |

| *FUNCTION* | **dsp_reject** |
|---|---|
| *PURPOSE* | Send the "reject" signal |
| *SYNTAX* | `int dsp_reject(void)` |
| *INCLUDES* | `#include "comfrc_header.h"`<br>`#include "display.h"` |
| *DESCRIPTION* | Sends a signal to reject the last point sent through the serial connection. |

| FUNCTION | **dsp_send** | |
|---|---|---|
| PURPOSE | Send a character to the terminal device | |
| SYNTAX | `int dsp_send(int dsp, char *s)` | |
| | `int dsp;` | handle to the serial port connection |
| | `char *s;` | character to send |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| DESCRIPTION | Sends a character to the terminal device | |

| FUNCTION | **get_act_channel** | |
|---|---|---|
| PURPOSE | Obtain the actuator channels that controls the elevator and rudder | |
| SYNTAX | `int get_act_channel(ActDataPtr adp, char *db_name)` | |
| | `ActDataPtr adp;` | Actuator Data pointer |
| | `char *db_name;` | data block variable name |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| DESCRIPTION | Obtains the actuator channels corresponding to the elevator and rudder by comparing the `db_name` with DELE and DELR and the actuator description in `adp` with "Elev" and "Rud" | |

| FUNCTION | **get_dbvalue** | |
|---|---|---|
| PURPOSE | Returns the value of the variable indicated by `dbname` | |
| SYNTAX | `double get_dbvalue(char *dbname, CurrentLinePtr clp, int idx)` | |
| | `char *dbname;` | data block variable name |
| | `CurrentLinePtr clp;` | Current Line pointer |
| | `int idx;` | actuator channel index number |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "display.h"` | |
| DESCRIPTION | Returns the value of the variable in `clp` indicated by `dbname` | |

| FUNCTION | **CancelCallback** | |
|---|---|---|
| PURPOSE | Callback function for Cancel on SetUpActuatorsDialog | |
| SYNTAX | `void CancelCallback(Widget w, int *finished, XmPushButtonCallbackStruct *cbs)` | |
| | `Widget w` | parent widget ID |
| | `int *finished` | return finished value of 1 |
| | `XmPushButtonCallbackStruct *cbs` | callback structure information for cancel push button |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Returns a value of 1 for finished variable to close the dialog | |

| FUNCTION | **CheckBoxCallback** | |
|---|---|---|
| PURPOSE | Callback routine for the "Use different Config File" CheckBox widget | |
| SYNTAX | `void CheckBoxCallback (Widget parent, GlobalPtr gp, XmToggleButtonCallbackStruct *toggle_status)` | |
| | `Widget parent` | widget parent ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `XmToggleButtonCallbackStruct *toggle_status` | Callback structure information for the checkbox |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Sets the sensitivity and contents of the config file combo box | |

| FUNCTION | **CreateButton** | |
|---|---|---|
| PURPOSE | Create pushbutton controls for the File Dialog | |
| SYNTAX | `void CreateButton(Widget parent, ControlButtonItem *buttons, int num_buttons)` | |
| | `Widget parent` | parent widget ID |
| | `ControlButtonItem *buttons` | structure containing information about the buttons of the file dialog |
| | `int num_buttons` | number of buttons |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Creates the push buttons of the file dialog and sets up callbacks | |

| FUNCTION | **CreateCheckBox** | |
|---|---|---|
| PURPOSE | Establish a checkbox widget for "Using different Config File" | |
| SYNTAX | `Widget CreateCheckBox(Widget parent, GlobalPtr gp)` | |
| | `Widget parent` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Creates the checkbox for "Using different Config File" on the FileDialog | |

| *FUNCTION* | **CreateFileComboBox** | |
|---|---|---|
| *PURPOSE* | Create File Combo box for the File Dialog | |
| *SYNTAX* | void CreateFileComboBox(Widget parent,<br>FileDialogComboBoxItem *cbox,<br>Widget checkbox, int item_no, Boolean online, Boolean sensitive,<br>GlobalPtr gp) | |
| | Widget parent | parent widget ID |
| | FileDialogComboBox Item *cbox | structure containing button and button callback information |
| | Widget checkbox | checkbox widget ID |
| | int item_no | combo box item in "cbox" |
| | Boolean online | Boolean variable true for online run |
| | Boolean sensitive | Boolean variable true for active |
| | GlobalPtr gp | Global Comfrc pointer |
| *INCLUDES* | #include "comfrc_header.h"<br>#include "comfrc.h"<br>#include "onlinefrc.h"<br>#include "offlineASE.h"<br>#include "mDB_Indx.h" | |
| *DESCRIPTION* | Creates a combo box with the list of appropriate filenames | |

| *FUNCTION* | **DataFileCallback** | |
|---|---|---|
| *PURPOSE* | Callback function for DataFile combo box selection | |
| *SYNTAX* | void DataFileCallback(Widget w, Widget checkbox,<br>int num_buttons) | |
| | Widget w | parent widget ID |
| | Widget checkbox | checkbox widget ID |
| *INCLUDES* | #include "comfrc_header.h"<br>#include "comfrc.h"<br>#include "onlinefrc.h"<br>#include "offlineASE.h"<br>#include "mDB_Indx.h" | |
| *DESCRIPTION* | When a data file is selected from the combo box, the "use different config file" checkbox and the contents of the ConfigFile box are reset | |

| FUNCTION | **GetFileList** | |
|---|---|---|
| PURPOSE | Get a list of all the files from a given sub-directory | |
| SYNTAX | `int GetFileList(char *dirname, XmStringTable file_list)` | |
| | `char *dirname` | directory name |
| | `XmStringTable file_list` | List of filenames |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Gets a list of all the files from a given sub-directory. Returns the number of files in the list | |

| FUNCTION | **OpenFileCancel** | |
|---|---|---|
| PURPOSE | Callback function for the "CANCEL" button in Open File Dialog | |
| SYNTAX | `void OpenFileCancel(Widget w, FileDialogCallbackStruct *fcs)` | |
| | `Widget w` | parent widget ID |
| | `FileDialogCallbackStruct *fcs` | callback structure information |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | cancels dialog | |

| FUNCTION | **OpenFileDialog** | |
|---|---|---|
| PURPOSE | Establish an Open File Dialog for comfrc | |
| SYNTAX | `void OpenFileDialog(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Creates the OpenFile Dialog for Comfrc and waits for response.<br>If OK is pressed:<br>1. A configuration file is read (function init called)<br>2. Datafile is set up if online test or read if offline test<br>3. Test schedule list is input to the text field on the Comfrc interface<br>4. If online, filedialog is closed and Setup of Actuators dialog is created<br>5. If offline, filedialog is closed and comfrc_offline is called | |

| FUNCTION | **OpenFileHelp** | |
|---|---|---|
| PURPOSE | Callback function for the "HELP " pushbutton in Open File Dialog | |
| SYNTAX | `void OpenFileHelp(Widget w, caddr_t client_data, XmAnyCallbackStruct *cbs)` | |
| | `Widget w;` | parent widget ID |
| | `caddr_t client_data;` | client data |
| | `XmAnyCallbackStruct *cbs;` | callback structure |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Currently not implemented | |

| FUNCTION | **OpenFileOK** | |
|---|---|---|
| PURPOSE | Call back routine for the "OK" pushbutton in OpenFile Dialog | |
| SYNTAX | `void OpenFileOK(Widget w, FileDialogCallbackStruct *fcs)` | |
| | `Widget w` | parent widget ID |
| | `FileDialogCallbackStruct *fcs` | callback structure information |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | When OK is pressed on the file dialog box the following is performed:<br>1. Check to see if datafile exists. If yes, warning dialog is posted and user can append, overwrite or cancel.<br>2. Data file, Config file and test schedule file are copied to their respective text fields on the main Comfrc application interface<br>3. The application Monfrc is started (if online test) using the correct config file | |

| FUNCTION | **ResetCallback** | |
|---|---|---|
| PURPOSE | Callback function for Reset pushbutton on SetUpActuatorsDialog | |
| SYNTAX | `void ResetCallback(Widget w, int *reset, XmPushButtonCallbackStruct *cbs)` | |
| | `Widget w` | parent widget ID |
| | `int *finished` | return reset value of 2 |
| | `XmPushButtonCallbackStruct *cbs` | callback structure information for cancel push button |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Sets reset command to actuators and returns a value of 1 for reset variable. | |

| FUNCTION | **SetConfigFileBox** | |
|---|---|---|
| PURPOSE | Set the contents of the Config File Combo Box | |
| SYNTAX | `void SetConfigFileBox(Widget checkbox, Boolean new_file)` | |
| | `Widget checkbox` | checkbox widget ID |
| | `Boolean new_file` | Boolean value true if new file |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Sets the contents of the config file combo box with the config filename contained in the datafile | |

| FUNCTION | **SetUpActuatorsDialog** | |
|---|---|---|
| PURPOSE | Creates a dialog to inform user of setup progress of actuators | |
| SYNTAX | `void SetUpActuatorsDialog(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Creates a dialog for the setup of actuators. When setup is complete, dialog will close. If error occur in setting up, error message will be displayed. User may then cancel or reset the actuators again. | |

| FUNCTION | **trim_trailing_spaces** | |
|---|---|---|
| PURPOSE | Trim off Trailing spaces from a given string | |
| SYNTAX | `void trim_trailing_spaces(char *line)` | |
| | `Char *line` | line of characters |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "offlineASE.h"`<br>`#include "mDB_Indx.h"` | |
| DESCRIPTION | Trims the trailing spaces off a string and returns | |

| *FUNCTION* | **Find_Fmt** | |
|---|---|---|
| *PURPOSE* | Searches for `String` in file `fp`, then returns file pointer to original position | |
| *SYNTAX* | `int Find_Fmt(FILE *fp, const char *String)` | |
| | `FILE *fp` | Search File pointer |
| | `const char *String` | Search string |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | This function searches for `String` in file `fp`, then returns file pointer to original position. If string is found returns 1 else 0 | |

| *FUNCTION* | **FndNextLine** | |
|---|---|---|
| *PURPOSE* | Reads file `fp` until the next valid line is reached. | |
| *SYNTAX* | `int FindNextLine(FILE *fp, char *Line)` | |
| | `FILE *fp` | File pointer |
| | `char *Line` | valid line |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | This function reads `fp` until the next valid line is reached. All lines beginning with % are skipped. If a valid line is found it returns 0, otherwise 1. | |

| FUNCTION | Find_Var | |
|---|---|---|
| PURPOSE | Finds a specified string within a specified file | |
| SYNTAX | `int Find_Var(FILE *ifp, char *String, char *Line)` | |
| | `FILE *ifp` | File pointer |
| | `char *String` | Search string |
| | `char *Line` | Line of characters |
| INCLUDES | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function searches for `String` in the current `Line` and continues through the file until it is found (returns 0) or EOF is reached (returns 1). | |

| FUNCTION | init | |
|---|---|---|
| PURPOSE | Does initialisation for wind tunnel test | |
| SYNTAX | `int init(GlobalPtr gp, long *offset)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `long *offset` | file position indicator |
| INCLUDES | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function does all of the initialisation required for a wind tunnel test.<br>It reads the contents of the configuration file and determines what data is to be acquired and stored in the data file.<br>If online test, it outputs the header to the raw data file and reads in the test schedule file.<br>If offline test, it checks the raw data file and configuration file for compatibility.<br>Initialisation of the turntable and actuator modules is also performed.<br>Initialisation of printout subroutines.<br>Initialisation of block and line counters and various flags.<br>If online test, initialisation of the Freestream module and inclinometer module | |

| *FUNCTION* | **ReadCharArray** | |
|---|---|---|
| *PURPOSE* | Splits a string (`Line`) into an array of sub-strings, which are separated by one or more spaces, or tabs. | |
| *SYNTAX* | `int ReadCharArray(char *param[], char *Line)` | |
| | `char *param[]` | Array of sub-strings |
| | `char *Line` | Search string |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | This function splits a string (`Line`) into an array of sub-strings, which are separated by one or more spaces, or tabs. It returns the number of sub-strings found. | |

| *FUNCTION* | **Read_Config_File** | |
|---|---|---|
| *PURPOSE* | Reads all configuration data from the supplied configuration file | |
| *SYNTAX* | `int Read_Config_File(ConfigDataPtr cdp, char* Filename)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `char *Filename` | filename of the Configuration File |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | Opens the configuration file specified. If it is not a 'new format' configuration file it calls `Read_Old_Configfile`. The following configuration data is read and placed into `ConfigDataPtr`:<br>1. Title, customer, description lines<br>2. File/block constants/variables<br>3. Reference lengths and areas<br>4. Interference parameters<br>5. Power propeller required and propeller diameter<br>6. Mount type and source of attitude data<br>7. Balance offsets and sensor attitude offsets<br>8. Balance calibration matrices and units<br>9. Balance deflection matrices<br>10. Balance safeloads<br>11. Tareweight matrix<br>12. Whether sampling is required and the number of samples<br>13. Output format | |

| FUNCTION | Read_Old_Config_File | |
|---|---|---|
| PURPOSE | Reads all configuration data from the supplied configuration file (of the old format) | |
| SYNTAX | `int Read_Old_Config_File(ConfigDataPtr cdp, FILE *ifp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `FILE *ifp` | Configuration File pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function reads all of the configuration data from an 'old format' configuration file into `ConfigDataPtr` (see `Read_Config_File`). | |

| FUNCTION | ReadSchedFile | |
|---|---|---|
| PURPOSE | Reads the test schedule information from the specified Test Schedule file into a `SchedFilePtr` | |
| SYNTAX | `int ReadSchedFile(SchedFilePtr sfp, char *SchedFile)` | |
| | `SchedFilePtr sfp` | Schedule File information pointer |
| | `char *SchedFile` | Schedule filename |
| INCLUDES | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function reads the header from the specified test schedule file to obtain the parameters in the test schedule. It also reads the tolerance value for each of these parameters. It then reads each data line in the test schedule file and interprets it as a first/final zero, block end or a valid data line. If it is a valid data line it reads each of the parameter values into a linked list. | |

| *FUNCTION* | **Read_Vector** | |
|---|---|---|
| *PURPOSE* | Reads numbers from a string into a vector | |
| *SYNTAX* | `int Read_Vector(char *Line, double *x, int n)` | |
| | `char *Line` | string of numbers |
| | `double *x` | array |
| | `int n` | number of elements |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | This function searches a string for numbers separated by spaces or tabs and places the numbers into a vector of type `double`. Returns 0 upon successful completion, returns 1 otherwise. | |

| *FUNCTION* | **Write_Config_File** | |
|---|---|---|
| *PURPOSE* | Writes configuration data in the `ConfigDataPtr` to a file | |
| *SYNTAX* | `void Write_Config_File(ConfigDataPtr cdp, char *Filename)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `char *Filename` | Configuration Filename |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "debugs.h"`<br>`#include "prtout.h"`<br>`#include "display.h"`<br>`#include "initModules.h"` | |
| *DESCRIPTION* | This function writes a configuration file with all of the configuration data currently stored in the `ConfigDataPtr`. | |

| FUNCTION | hostZero | |
|---|---|---|
| PURPOSE | Writes the inclinometer offsets contained in the modules initialisation file down to the Inclinometer Module | |
| SYNTAX | `void hostZero(char *inifile)` | |
| | `char *inifile` | modules initialisation file |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function writes the inclinometer offsets contained in the modules initialisation file down to the Inclinometer Module | |

| FUNCTION | initFs | |
|---|---|---|
| PURPOSE | Does initialisation of the Freestream Module | |
| SYNTAX | `void initFs(char *inifile, ConfigDataPtr cdp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `char *inifile` | modules initialisation file |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function sets the Reynolds number length from `ConfigDataPtr` to the Freestream Module | |

| FUNCTION | initInc | |
|---|---|---|
| PURPOSE | Does initialisation of the Inclinometer Module | |
| SYNTAX | `void initInc(char *inifile)` | |
| | `char *inifile` | modules initialisation file |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function does a `hostZero` of the Inclinometer Module. It sends down the inclinometer offsets obtained from the modules initialisation file to the Inclinometer Module. | |

| FUNCTION | initSCR | |
|---|---|---|
| PURPOSE | Does initialisation of Sting Column Rig | |
| SYNTAX | `void initSCR(char *inifile)` | |
| | `char *inifile` | modules initialisation file |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function reads the height offset of the Sting Column Rig from the modules initialisation file and writes it to the module. | |

| FUNCTION | initTurntable | |
|---|---|---|
| PURPOSE | Does initialisation of Turntable Module | |
| SYNTAX | `void initTurntable(char *inifile, TurntableDataPtr tdp)` | |
| | `char *inifile` | modules initialisation file |
| | `TurntableDataPtr` | Turntable Data pointer |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function reads from the modules initialisation file, the valid turntables and their angle offsets and places this information in the `TurntableDataPtr`. | |

| FUNCTION | selfZero | |
|---|---|---|
| PURPOSE | Performs a "zero" of the inclinometer | |
| SYNTAX | `void selfZero(char *inifile)` | |
| | `char *inifile` | modules initialisation file |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function reads the accelerometer angles from the Inclinometer Module and writes them as offsets to the modules initialisation file and down to the Inclinometer Module itself to "zero" the inclinometer. | |

| FUNCTION | setReNoLength | |
|---|---|---|
| PURPOSE | Writes the Reynolds Number length down to the Freestream Module for correct calculation and display of Reynolds number. | |
| SYNTAX | `void setReNoLength(double renlen)` | |
| | `double renlen` | Reynolds Number length |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` | |
| DESCRIPTION | This function writes the Reynolds Number length down to the Freestream Module for correct calculation and display of Reynolds number. | |

| FUNCTION | streamAllModules |
|---|---|
| PURPOSE | Sends a streaming command to all communicable modules |
| SYNTAX | `void streamAllModules()` |
| INCLUDES | `#include "mDB_Indx.h"`<br>`#include "moduleComms.h"`<br>`#include "ReadFromIniFile.h"`<br>`#include "initModules.h"` |
| DESCRIPTION | This function sends a streaming command to all communicable modules. |

| FUNCTION | input_offline | |
|---|---|---|
| PURPOSE | Inputs data from a raw data file | |
| SYNTAX | `int input_offline(RawDataPtr rdp, LocalDataPtr ldp, CurrentLinePtr clp, long *offset)` | |
| | `RawDataPtr rdp` | Raw Data pointer |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| | `long *offset` | file position offset |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "debugs.h"`<br>`#include "DataAcqFuncs.h"` | |
| DESCRIPTION | This function opens the raw data file and reads in the header information and raw data lines into `RawDataPtr`. | |

| FUNCTION | input_online | |
|---|---|---|
| PURPOSE | Acquires a line of data from the instrumentation modules | |
| SYNTAX | `int input_online(GlobalPtr gp, int zero_line)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `int zero_line` | =1 if a zero line |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "debugs.h"`<br>`#include "DataAcqFuncs.h"` | |
| DESCRIPTION | This function acquires a line of data from the instrumentation modules and places it into `RawDataPtr` according to raw data file header information defined in `init`. | |

| FUNCTION | CheckStatus | |
|---|---|---|
| PURPOSE | This is the timeout procedure for the moving dialog, which continually updates the current wind tunnel parameter values and the movement status indicators. It also indicates whether current values are within tolerance of the test schedule file setpoints. | |
| SYNTAX | `int CheckStatus(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "mDB_Indx.h"`<br>`#include "mdl_cntrl.h"` | |
| DESCRIPTION | This function checks the move status on the actuators and sting column rig. It also updates the current values of the wind tunnel parameters displayed on this screen.<br>The background of the text boxes of the current values will continually be updated with one of the following colours:<br>Green: NO movement AND the current value is within tolerance of the setpoint (if tolerances are applied)<br>Orange: NO movement AND the current value is outside of the tolerance on the setpoint (if tolerances are applied)<br>Red: MOVING<br>The message box will be updated to report any actions taken and the current status. | |

| FUNCTION | close_cb | |
|---|---|---|
| PURPOSE | This is the Close button callback for the moving dialog | |
| SYNTAX | `void close_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "mDB_Indx.h"`<br>`#include "mdl_cntrl.h"` | |
| DESCRIPTION | This function sets the flag `gp->sfp-msp->close_moving_dialog` to 1 which will cause the moving dialog to close. | |

| FUNCTION | move_cb | |
|---|---|---|
| PURPOSE | This is the Move button callback for the moving dialog | |
| SYNTAX | `void move_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "mDB_Indx.h"`<br>`#include "mdl_cntrl.h"` | |
| DESCRIPTION | This function obtains the setpoint values from the textboxes on the moving dialog and checks them for target angle errors. If no errors, a move command is sent to the actuators and/or Sting Column Rig. | |

| FUNCTION | move_online | |
|---|---|---|
| PURPOSE | Creates a dialog on the Comfrc interface to show test schedule file parameter setpoints, current values and movement status. | |
| SYNTAX | `void move_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "mDB_Indx.h"`<br>`#include "mdl_cntrl.h"` | |
| DESCRIPTION | This function creates a dialog on the Comfrc interface to show test schedule file parameter setpoints, current values and the movement status. This dialog is displayed when a move command is initiated or when the manual setpoint button is pressed on the Comfrc interface. The buttons located on this window are Move, Stop, Close. A message area will inform the user of the current status. When a move has been initiated, any key press will abort the move.<br>A time out procedure is implemented to update the current values and movement status indicators.<br>If in semi or fully auto mode, the application will immediately attempt a move to the current test schedule setpoints when this window is displayed. When the move is complete and all parameters are within tolerance then the dialog will automatically close. | |

| FUNCTION | stop_cb | |
|---|---|---|
| PURPOSE | This is the Stop button callback for the moving dialog | |
| SYNTAX | `void stop_cb(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"`<br>`#include "comfrc.h"`<br>`#include "mDB_Indx.h"`<br>`#include "mdl_cntrl.h"` | |
| DESCRIPTION | This function sends a stop command to the actuators and/or the Sting Column Rig to abort a move. | |

| FUNCTION | wprint | |
|---|---|---|
| PURPOSE | Writes formatted output to text widgets | |
| SYNTAX | `void wprint(va_alist)` | |
| | `va_alist` | variable argument list |
| INCLUDES | `#include <varargs.h`<br>`#include <ctype.h`<br>`#include <Xm/Xm.h`<br>`#include <Xm/Text.h` | |
| DESCRIPTION | This function allows the programmer to write formatted output to an X text widget. The function takes the following form:<br>`wprint` (X Text widget, " formatted text ", variables) | |

| FUNCTION | average | |
|---|---|---|
| PURPOSE | Finds the average of the first and final zeros and calculates the buoyant zeros. | |
| SYNTAX | `int average(ConfigDataPtr cdp, LocalDataPtr ldp, ZeroDataPtr zdp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| | `ZeroDataPtr zdp` | Zero Data pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function finds the average of the first and final zeros and calculates the buoyant zeros. | |

| FUNCTION | chekit | |
|---|---|---|
| PURPOSE | Checks zero lines for consistency of attitude. | |
| SYNTAX | `int chekit(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function checks zero lines for consistency of attitude and is only called if the current line has been identified as a zero line.<br>If it is a first zero line then the zero values are assigned to the zero data<br>If it is a final zero then the first and final zero strain gauge values are checked for consistency. If outside a tolerance of 0.02V a warning is issued. | |

| FUNCTION | convert_data | |
|---|---|---|
| PURPOSE | Converts one raw data line to engineering units | |
| SYNTAX | `int convert_data(GlobalPtr gp, CurrentLinePtr clp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function converts one raw data line to engineering units | |

| FUNCTION | FindFileConstIndex | |
|---|---|---|
| PURPOSE | Finds whether the specified file constant exists in the `ConfigDataPtr` | |
| SYNTAX | `int FindFileConstIndex(ConfigDataPtr cdp, char *fconst)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `char *fconst` | file constant string |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function finds whether the specified file constant exists in the `ConfigDataPtr` | |

| FUNCTION | hextodec | |
|---|---|---|
| PURPOSE | Converts 2 word parameters to the correct integer format | |
| SYNTAX | `double hextodec(int upper, int lower)` | |
| | `int upper` | upper word |
| | `int lower` | lower word |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function converts 2 word parameters to the correct integer format | |

| FUNCTION | normal | |
|---|---|---|
| PURPOSE | Processes a normal data line | |
| SYNTAX | `int normal(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function processes a normal raw data line to engineering units and coefficients.<br>Firstly, if sampling is not being done, the data is converted to engineering units.<br>If the data line is a first or final zero, the buoyant zeros are calculated. If it is a final zero, all data is then reprocessed through `calall` based on the new buoyant zeros.<br>If the data line is a normal force data line then the strain gauge voltages are reduced to coefficients through calls to the functions `balred`, `tarewt`, `attmod`, `towind`, `toaxes`. The data is also then displayed on the `dspfrc` application. | |

| FUNCTION | printout | |
|---|---|---|
| PURPOSE | Outputs to the screen the current line values computed from the raw data values | |
| SYNTAX | `int printout(RawDataPtr rdp, CurrentLinePtr clp)` | |
| | `RawDataPtr rdp` | Raw Data pointer |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function outputs to the screen the current line values computed from the raw data values | |

| FUNCTION | sgdata | |
|---|---|---|
| PURPOSE | Converts raw strain gauge data to a voltage | |
| SYNTAX | `double sgdata(int nData)` | |
| | `int nData` | raw strain gauge data |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function converts raw strain gauge data to a voltage | |

| FUNCTION | sortit | |
|---|---|---|
| PURPOSE | Determines whether a line is a zero line or a normal force data line | |
| SYNTAX | `int sortit(CurrentLinePtr clp)` | |
| | `CurrentLinePtr clp` | Current Line pointer |
| INCLUDES | `#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function determines whether a line is a zero line or a normal force data line by checking the airspeed is above or below a value of 5m/s | |

| *FUNCTION* | **CalculateX1invX2** | |
|---|---|---|
| *PURPOSE* | Calculates the X1inv matrix and performs the matrix multiplication X1inv * X2 | |
| *SYNTAX* | `int CalculateX1invX2(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc data pointer |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function calculates the X1 inv matrix and performs the matrix multiplication X1inv * X2 | |

| *FUNCTION* | **ConvertDeflConstFormat** | |
|---|---|---|
| *PURPOSE* | Converts the deflection matrix read in from the ASE2000 TWT data file to the LSWT format | |
| *SYNTAX* | `int ConvertDeflConstFormat(MatrixPtr defl_temp, GlobalPtr gp)` | |
| | `MatrixPtr defl_temp` | Matrix pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function converts the deflection matrix (`defl_temp`) read in from the ASE2000 TWT data file to the `ConfigDataPtr` in `GlobalPtr` (LSWT format) | |

| *FUNCTION* | **ConvertDMatrixAxesFormat** | |
|---|---|---|
| *PURPOSE* | Converts the D matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | |
| *SYNTAX* | `int ConvertDMatrixAxesFormat(MatrixPtr dtemp, GlobalPtr gp)` | |
| | `MatrixPtr dtemp` | Matrix pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function converts the D matrix (`dtemp`) read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the `ConfigDataPtr` in `GlobalPtr` (LSWT format X,l,Y,m,Z,n) | |

| *FUNCTION* | **ConvertTaresFormat** | |
|---|---|---|
| *PURPOSE* | Converts the tares matrix read in from the ASE2000 TWT data file to the LSWT format | |
| *SYNTAX* | `int ConvertTaresFormat(MatrixPtr tares_temp, GlobalPtr gp)` | |
| | `MatrixPtr tares_temp` | Matrix pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function converts the tares matrix (`tares_temp`) read in from the ASE2000 TWT data file to the `ConfigDataPtr` in `GlobalPtr` (LSWT format) | |

| FUNCTION | ConvertX1MatrixAxesFormat | |
|---|---|---|
| PURPOSE | Converts the X1 matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | |
| SYNTAX | `int ConvertX1MatrixAxesFormat(MatrixPtr x1temp, GlobalPtr gp)` | |
| | `MatrixPtr x1temp` | Matrix pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function converts the X1 matrix (`x1temp`) read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the `ConfigDataPtr` in `GlobalPtr` (LSWT format X,l,Y,m,Z,n) | |

| FUNCTION | ConvertX2MatrixAxesFormat | |
|---|---|---|
| PURPOSE | Converts the X2matrix read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the LSWT format (X,l,Y,m,Z,n) | |
| SYNTAX | `int ConvertX2MatrixAxesFormat(MatrixPtr x2temp, GlobalPtr gp)` | |
| | `MatrixPtr x2temp` | Matrix pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function converts the X2 matrix (`x2temp`) read in from the ASE2000 TWT data file (X,Y,Z,l,m,n format) to the `ConfigDataPtr` in `GlobalPtr` (LSWT format X,l,Y,m,Z,n) | |

| FUNCTION | offlineASE | |
|---|---|---|
| PURPOSE | Processes ASE2000 transonic wind tunnel data offline | |
| SYNTAX | `int offlineASE(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function processes ASE2000 transonic wind tunnel data offline. It calls `Read_Config_ASE` to read the configuration data and then calls either `offlineASEfrc` or `offlineASEtwt` depending on whether it is a force and moment test or a tareweight calculation. | |

| FUNCTION | offlineASEfrc | |
|---|---|---|
| PURPOSE | Reads and processes ASE2000 TWT force and moment data files offline | |
| SYNTAX | `int offlineASEfrc(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function reads ASE2000 TWT force and moment data files and then processes all data to coefficient form through the Comfrc routines.<br>1. Reads first and final zero strain gauge information from ASE2000 TWT data file and sets up zero data pointers.<br>2. Reads the header and identifies which column corresponds to which parameter.<br>3. Reads all data into `CurrentLinePtr` according to the sampling characteristics defined in the LSWT configuration file. Calculation and output of standard deviations if required.<br>4. Reads buoyant pitch, roll yaw attitudes.<br>5. Calculates buoyant zeros using `average`.<br>6. Calls `calall` to process all data and output results according to output format defined in the LSWT configuration file. | |

| FUNCTION | offlineASEtwt | |
|---|---|---|
| PURPOSE | Reads and processes ASE2000 TWT tareweight data offline | |
| SYNTAX | `int offlineASEtwt(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function reads ASE2000 TWT tareweight data and then processes all data to obtain the tareweight matrix through the Comfrc routines.<br>1. Reads first and final zero strain gauge information from a data file called `ASEtwt.dat` that contains pitch and roll attitudes with all 6 strain gauge values.<br>2. Calls `average` to calculate buoyant zeros.<br>3. Calls `prtini_twt` to print the header of the tareweight output file<br>4. Calls `calalltwt` to process all data using the calibration matrices obtained from a specified ASE2000 TWT data file, and outputs the calculated tareweight matrix. | |

| FUNCTION | Read_Config_ASE | |
|---|---|---|
| PURPOSE | Reads in the configuration data from both the ASE2000 transonic wind tunnel data file and a LSWT configuration file | |
| SYNTAX | `int Read_Config_ASE(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function reads in all configuration data required from the ASE2000 transonic wind tunnel data file.<br>Also reads in the output format, sampling characteristics, wind tunnel corrections required and base pressure required from a LSWT configuration file | |

| *FUNCTION* | **ReadParameterMatrix** | |
|---|---|---|
| *PURPOSE* | Searches for the header in the ASE2000 TWT data file and then reads in the matrix on the following lines according to the number of rows and columns specified | |
| *SYNTAX* | `int ReadParameterMatrix(FILE *ifp, char *header, MatrixPtr mp, int nrows, int ncols)` | |
| | `FILE *ifp` | Data File pointer |
| | `char *header` | Search header |
| | `MatrixPtr mp` | general matrix pointer containing all elements |
| | `int nrows` | number of rows in the matrix |
| | `int ncols` | number of columns in the matrix |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function searches for the header in the ASE2000 TWT data file and then reads in the matrix on the following lines according to the number of rows and columns specified | |

| *FUNCTION* | **ReadParameterString** | |
|---|---|---|
| *PURPOSE* | Searches for the header in the ASE2000 TWT data file and then reads in the string on the following line | |
| *SYNTAX* | `int ReadParameterString(FILE *ifp, char *header, char *string)` | |
| | `FILE *ifp` | Data File pointer |
| | `char *header` | Search header |
| | `char *string` | returned string on the line following the search header |
| *INCLUDES* | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| *DESCRIPTION* | This function searches for the header in the ASE2000 TWT data file and then reads in the string on the following line. | |

| FUNCTION | ReadParameterValue | |
|---|---|---|
| PURPOSE | Searches for the header in the ASE2000 TWT data file and then reads in the value on the following line | |
| SYNTAX | `int ReadParameterValue(FILE *ifp, char *header, double *value)` | |
| | `FILE *ifp` | Data File pointer |
| | `char *header` | Search header |
| | `double *value` | returned value on the line following the search header |
| INCLUDES | `#include "initfrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "nrutil.h"`<br>`#include "prtout.h"` | |
| DESCRIPTION | This function searches for the header in the ASE2000 TWT data file and then reads in the value on the following line. | |

| FUNCTION | comfrc_offline | |
|---|---|---|
| PURPOSE | Performs off-line computation of raw data for Comfrc | |
| SYNTAX | `comfrc_offline(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "offlinefrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function performs off-line computation of raw data for Comfrc. Calls `input_offline` to get a line of raw data from the file. If sampling is specified then it calls `sample_data_offline` otherwise it calls `normal` to process the data line.<br>Output is put to the text widget on the main Comfrc interface.<br>When the first and final zeros have been read in then the function calls the appropriate `calall` to process all data using the first and final zero data. | |

| *FUNCTION* | **read_dataline_offline** | |
|---|---|---|
| *PURPOSE* | Reads a line of raw data knowing that it is only data. Called in the offline sampling case | |
| *SYNTAX* | `read_dataline_offline(RawDataPtr rdp, LocalDataPtr ldp, long *offset)` | |
| | `RawDataPtr rdp` | Raw Data pointer |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| | `long *offset` | file position locater in raw data file |
| *INCLUDES* | `#include "offlinefrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function reads a line of raw data knowing that it is only data. Called in the offline sampling case | |

| *FUNCTION* | **sample_data_offline** | |
|---|---|---|
| *PURPOSE* | Performs the processing of the data in the off-line case if sampling is required. It includes statistical computations. | |
| *SYNTAX* | `int sample_data_offline(GlobalPtr gp, long *offset)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `long *offset` | file pointer location in raw data file |
| *INCLUDES* | `#include "offlinefrc.h"`<br>`#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function performs the processing of the data in the off-line case if sampling is required.<br>For each sample it reads in a raw data line, converts to engineering units and cumulates the statistical information. It then calls `normal` to process the average of the samples to coefficient form and outputs standard deviations to a statistical file. | |

| FUNCTION | add_to_list | |
|---|---|---|
| PURPOSE | Allocates memory for another pointer after the last in the linked list and moves to that pointer | |
| SYNTAX | `CurrentLinePtr add_to_list(CurrentLinePtr last)` | |
| | `CurrentLinePtr last` | last pointer in linked list |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function allocates memory for another pointer after the last in the linked list and moves to that pointer | |

| FUNCTION | calculate_stats | |
|---|---|---|
| PURPOSE | Calculates the statistical information for the samples at each data point | |
| SYNTAX | `int calculate_stats(GlobalPtr gp, CurrentLinePtr sigmax, CurrentLinePtr sigmaxx, CurrentLinePtr stdevclp, double n)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `CurrentLinePtr sigmax` | Current Line pointer for sum of data samples |
| | `CurrentLinePtr sigmaxx` | Current Line pointer for sum of the squares of the data samples |
| | `CurrentLinePtr stdevclp` | Current Line pointer for the standard deviation of the data samples |
| | `double n` | number of samples |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function calculates the statistical information for the samples at each data point.<br>Using the sums of the parameters over every sample and the sums of the squares of the parameters over every sample, the standard deviation is calculated for that group of samples. | |

| *FUNCTION* | **comfrc_online** |
|---|---|
| *PURPOSE* | Performs on-line computation of raw data for Comfrc |
| *SYNTAX* | `comfrc_online(GlobalPtr gp)` |
| | `GlobalPtr gp` — Global Comfrc pointer |
| *INCLUDES* | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` |
| *DESCRIPTION* | This function simply interpret what command has been received from the Comfrc interface during an on-line test and calls the appropriate on-line function:<br>`get_data_online`<br>`firstz_online`<br>`finalz_online`<br>`reject_online`<br>`block_online`<br>`next_online`<br>`previous_online`<br>`history_online`<br>`help_online` |

| *FUNCTION* | **count** |
|---|---|
| *PURPOSE* | Returns the number of structures in the list pointed to by `head` |
| *SYNTAX* | `int count(CurrentLinePtr head)` |
| | `CurrentLinePtr head` — head of the linked list |
| *INCLUDES* | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` |
| *DESCRIPTION* | This function returns the number of structures in the list pointed to by `head` |

| *FUNCTION* | **cumulate_stats** | |
|---|---|---|
| *PURPOSE* | Cumulates the statistical information for the samples at each data point | |
| *SYNTAX* | `int cumulate_stats(GlobalPtr gp, CurrentLinePtr tempclp, CurrentLinePtr sigmax, CurrentLinePtr sigmaxx)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `CurrentLinePtr tempclp` | Current DataLine pointer |
| | `CurrentLinePtr sigmax` | Current Line pointer for sum of data samples |
| | `CurrentLinePtr sigmaxx` | Current Line pointer for sum of (data samples) squares |
| *INCLUDES* | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function cumulates the statistical information for the samples at each data point.<br>Sums the parameters over every sample in the data point.<br>Sums the squares of the parameters over every sample in the data point. | |

| FUNCTION | finalz_online | |
|---|---|---|
| PURPOSE | Acquires a final zero data line, sets the corresponding flag and reprocesses all data based on the first and final zero data | |
| SYNTAX | `finalz_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function acquires a final zero data line in the same manner as in `get_data_online`. It also sets the local final zero flags to TRUE to ensure the function `normal` interprets it as a zero line.<br>It recalculates all data based on the first and final zero data by calling `calall`.<br>The sensitivity of the first zero button on the Comfrc interface is turned on and the sensitivity of the other buttons are turned off. | |

| FUNCTION | find_penultimate | |
|---|---|---|
| PURPOSE | Returns the offset (file position) of the penultimate line of a file | |
| SYNTAX | `long find_penultimate(char *filename)` | |
| | `char *filename` | filename |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function returns the offset (file position) of the penultimate line of a file. | |

| FUNCTION | firstz_online | |
|---|---|---|
| PURPOSE | Acquires a first zero data line and sets the corresponding flag | |
| SYNTAX | `firstz_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function acquires a first zero data line in the same manner as in `get_data_online`. It also sets the local first zero flags to TRUE to ensure the function `normal` interprets it as a zero line.<br>The sensitivity of the first zero button on the Comfrc interface is turned off and the sensitivity of the other buttons are turned on. | |

| FUNCTION | get_data_online | |
|---|---|---|
| PURPOSE | Acquires data from the instrumentation modules, processes it and writes the raw data to a file | |
| SYNTAX | `get_data_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function acquires data from the instrumentation modules, processes it and writes the raw data to a file. If it is using the test schedule file in semi or fully auto mode then it will first try to move actuators/attitudes to their setpoints. It will also go to the next setpoint once data has been acquired.<br>If tolerances are applied, the data that is acquired is checked against the setpoints. If any parameter lies outside its tolerance, the user is prompted to accept or reject the acquired data. | |

| FUNCTION | help_online | |
|---|---|---|
| PURPOSE | Brings up available help documentation (currently not implemented) | |
| SYNTAX | `help_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function brings up available help documentation (currently not implemented) | |

| FUNCTION | history_online | |
|---|---|---|
| PURPOSE | Performs history plot on `dspfrc` (currently not implemented) | |
| SYNTAX | `history_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function performs history plot on `dspfrc` (currently not implemented) | |

| FUNCTION | init_block | |
|---|---|---|
| PURPOSE | Initialises a new block in Comfrc | |
| SYNTAX | `int init_block(LocalDataPtr ldp)` | |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function initialises a new block in Comfrc and resets flags. | |

| FUNCTION | next_online | |
|---|---|---|
| PURPOSE | Prepares for the next setpoint in the test schedule file | |
| SYNTAX | `next_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function prepares for the next setpoint in the test schedule file by highlighting it in the test schedule field on the Comfrc interface and incrementing the test schedule file linked list pointer.<br>If in fully auto mode, it will interpret the next setpoint and take action automatically whether it is to do a `block_online` or a `get_data_online`, including moving actuators/attitudes. | |

| FUNCTION | normaldata_to_widget | |
|---|---|---|
| PURPOSE | Outputs results from `normal` to a text widget on the Comfrc application interface | |
| SYNTAX | `normaldata_to_widget(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function outputs results from `normal` to a text widget (`gp->xwp->data_text`) on the Comfrc application interface | |

| *FUNCTION* | **prev_online** | |
|---|---|---|
| *PURPOSE* | Prepares for the previous setpoint in the test schedule file | |
| *SYNTAX* | `prev_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function prepares for the previous setpoint in the test schedule file by highlighting it in the test schedule field on the Comfrc interface and decrementing the test schedule file linked list pointer.<br>If in fully auto mode, it will interpret the previous setpoint and take action automatically whether it is to do a `block_online` or a `get_data_online`, including moving actuators/attitudes. | |

| *FUNCTION* | **reject_online** | |
|---|---|---|
| *PURPOSE* | Rejects the last line of data that was acquired | |
| *SYNTAX* | `reject_online(Widget w, GlobalPtr gp)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| *INCLUDES* | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| *DESCRIPTION* | This function rejects the last line of data that was acquired.<br>The data line is deleted from the linked list and the raw data file is rewritten without the last line of data. If sampling was required, it removes all samples and also rewrites the statistical file without the last line of data.<br>A first or final zero or block end cannot be rejected. | |

| FUNCTION | sample_data_online | |
|---|---|---|
| PURPOSE | Performs the sampling and processing of the data in the on-line case. It includes statistical computations. | |
| SYNTAX | `int sample_data_online(GlobalPtr gp, int zero_line)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `int zero_line` | =1 if a zero line |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function performs the sampling and processing of the data in the on-line case.<br>It displays a dialog on the Comfrc interface to show the progress of the acquisition of each sample. For each sample it acquires a raw data line, writes it to the raw data file, converts to engineering units and cumulates the statistical information. It then calls `normal` to process the average of the samples to coefficient form and outputs standard deviations to a statistical file. | |

| FUNCTION | stdev | |
|---|---|---|
| PURPOSE | Calculates the standard deviation from the sum, the sum of the squares and the number of samples | |
| SYNTAX | `double stdev(double sigmax, double sigmaxx, double n)` | |
| | `double sigmax` | sum of data samples |
| | `double sigmaxx` | sum of the squares of the data samples |
| | `double n` | number of samples |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function calculates the standard deviation from the sum, the sum of the squares and the number of samples. It returns the standard deviation. | |

| FUNCTION | string_to_widget | |
|---|---|---|
| PURPOSE | Outputs a string to a text widget on the Comfrc application interface | |
| SYNTAX | `string_to_widget(Widget w, GlobalPtr gp, char *s)` | |
| | `Widget w` | parent widget ID |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `char *s` | string to be output |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function outputs a string to a text widget (`gp-xwp-data_text`) on the Comfrc application interface | |

| FUNCTION | TakeDataSamples | |
|---|---|---|
| PURPOSE | Obtains data samples and displays a working dialog on the Comfrc interface to indicate the progress of data acquisition | |
| SYNTAX | `void TakeDataSamples(GlobalPtr gp, int zero_line, CurrentLinePtr tempclp, CurrentLinePtr sigmax, CurrentLinePtr sigmaxx)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `int zero_line` | =1 if zero line |
| | `CurrentLinePtr tempclp` | Current Data Line pointer |
| | `CurrentLinePtr sigmax` | Current Line pointer for sum of data samples |
| | `CurrentLinePtr sigmaxx` | Current Line pointer for sum of the squares of the data samples |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function displays a working dialog on the Comfrc interface to show the progress of acquisition of data samples.<br>Each sample of raw data is acquired, written to the file, converted to engineering units, and statistical information is accumulated.<br>Dialog is closed when the required number of samples has been acquired. | |

| FUNCTION | write_rawdata_line | |
|---|---|---|
| PURPOSE | Writes a single line of acquired raw data to the raw data file | |
| SYNTAX | `write_rawdata_line(GlobalPtr gp, long *offset)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `long *offset` | file pointer location in raw data file |
| INCLUDES | `#include "onlinefrc.h"`<br>`#include "comfrc_header.h"`<br>`#include "normalfrc.h"`<br>`#include "schedule.h"`<br>`#include "debugs.h"` | |
| DESCRIPTION | This function writes a single line of acquired raw data to the raw data file | |

| FUNCTION | prtini | |
|---|---|---|
| PURPOSE | Prints the header information to the results output file and statistics file (if sampling required) for a force and moment test | |
| SYNTAX | `int prtini(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "prtout.h"` | |
| DESCRIPTION | This function prints the header information to the results output file and statistics file (if sampling required) for a force and moment test. | |

| FUNCTION | prtini_twt | |
|---|---|---|
| PURPOSE | Prints the header information to the results output file and statistics file (if sampling required) for a tareweight calculation | |
| SYNTAX | `int prtini_twt(ConfigDataPtr cdp, LocalDataPtr ldp)` | |
| | `ConfigDataPtr cdp` | Configuration Data pointer |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| INCLUDES | `#include "prtout.h"` | |
| DESCRIPTION | This function prints the header information to the results output file and statistics file (if sampling required) for a tareweight calculation. | |

| *FUNCTION* | **prtblk** | |
|---|---|---|
| *PURPOSE* | Outputs a blank line to the output results file and statistics file (if sampling required) to indicate a new block | |
| *SYNTAX* | `int prtblk(LocalDataPtr ldp, int sampling, int from_block_online)` | |
| | `LocalDataPtr ldp` | Local Comfrc data pointer |
| | `int sampling` | =1 if sampling required |
| | `int from_block_online` | =1 if called from `block_online` |
| *INCLUDES* | `#include "prtout.h"` | |
| *DESCRIPTION* | This function outputs a blank line to the output results file and statistics file (if sampling required) to indicate a new block | |

| *FUNCTION* | **prtline** | |
|---|---|---|
| *PURPOSE* | Outputs a line of processed data to the output results file according to the output format defined in the `ConfigDataPtr`. | |
| *SYNTAX* | `int prtline(CurrentLinePtr clp, GlobalPtr gp, char *outfile)` | |
| | `CurrentLinePtr clp` | Current Data Line pointer |
| | `GlobalPtr gp` | Global Comfrc pointer |
| | `char *outfile` | output file |
| *INCLUDES* | `#include "prtout.h"` | |
| *DESCRIPTION* | This function outputs a line of processed data to the output results file according to the output format defined in the `ConfigDataPtr`. | |

| *FUNCTION* | **prtstdev** | |
|---|---|---|
| *PURPOSE* | Outputs a line of standard deviations of certain parameters for each group of samples | |
| *SYNTAX* | `int prtstdev(CurrentLinePtr stdevclp, char *outfile)` | |
| | `CurrentLinePtr stdevclp` | Current Line pointer for the standard deviation of each group of samples |
| | `char *outfile` | output file |
| *INCLUDES* | `#include "prtout.h"` | |
| *DESCRIPTION* | This function outputs a line of standard deviations of certain parameters for each group of samples. | |

| FUNCTION | AddPaddingSpaces | |
|---|---|---|
| PURPOSE | Adds padding spaces to space out the header items above the test schedule field | |
| SYNTAX | `void AddPaddingSpaces(char *output_line, char *line_buf)` | |
| | `char *output_line` | final string of spaced header items |
| | `char *line_buf` | original string of header items |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | This function adds padding spaces to space out the header items above the test schedule field. | |

| FUNCTION | InputScheduleList | |
|---|---|---|
| PURPOSE | Opens the test schedule file and loads in the header items and parameter values to the test schedule field on the Comfrc interface | |
| SYNTAX | `void InputScheduleList(GlobalPtr gp)` | |
| | `GlobalPtr gp` | Global Comfrc pointer |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | This function opens the test schedule file and loads in the header items and parameter values to the test schedule field on the Comfrc interface. Sets the schedule position to the first item in the list. Sets the test schedule mode and apply tolerance checkbox on the Comfrc interface. | |

| FUNCTION | SetSchedulePosition | |
|---|---|---|
| PURPOSE | Increments the test schedule file list by the increment amount and highlights the current position | |
| SYNTAX | `void SetSchedulePosition(Widget list_field, int nIncrement)` | |
| | `Widget list_field` | Test Schedule field widget ID |
| | `int nIncrement` | Increment amount |
| INCLUDES | `#include "comfrc_header.h"` | |
| DESCRIPTION | This function increments the test schedule file list by the increment amount and highlights the current position | |

# Appendix C: MONFRC Software Functions

## C.1. MONFRC Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| act_gauge | Draws the actuator graphic (if defined), and the actuator angle in degrees, according to the actuator initialisation file | acts.c |
| act_overlay | Draws the actuator description using a bitmap font in the overlay plane | acts.c |
| CreateActDisplayLists | Calls functions to create polygon display lists for any actuator graphics | acts.c |
| DrawElevatorGraphic | Draws a graphic of a PC9[1] tail with a moving elevator actuator | acts.c |
| DrawRudderGraphic | Draws a graphic of a PC9 tail with a moving rudder actuator | acts.c |
| CreateAuxDisplayLists | Calls functions to create polygon display lists for any graphics for the auxiliary module | aux.c |
| rps_gauge | Draws a rotating propeller graphic, rps value and units in the normal plane | aux.c |
| rps_overlay | Draws an RPS title using a bitmap font in the overlay plane | aux.c |
| bar_gauge | Draws the moving parts of a general graphical bar gauge with warning levels and a parameter value in the normal plane | bar.c |
| bar_overlay | Draws the bar gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | bar.c |
| p_gauge | Draws the animated parts of a mercury barometer gauge and the pressure value with units of kPa in the normal plane | fs.c |
| p_overlay | Draws the mercury barometer gauge information required in the overlay plane including the gauge title, markings and scale | fs.c |

[1] Currently only the graphics for PC9 actuators are available. Actuator graphics for other models can be incorporated when required.

| | | |
|---|---|---|
| t_gauge | Draws the animated parts of a temperature gauge (mercury thermometer) and the temperature value with units of degrees C in the normal plane | fs.c |
| t_overlay | Draws the temperature gauge information required in the overlay plane including the gauge title, markings and scale | fs.c |
| v_gauge | Draws the animated parts of a velocity dial gauge with warning levels and the gauge value in m/s in the normal plane | fs.c |
| v_overlay | Draws the velocity dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | fs.c |
| angle_gauge | Draws the text value of another model angle (defined by the function arguments) with units of degrees in the normal plane (no graphic) | inc.c |
| angle_overlay | Draws the title (or description) of another model angle (defined by the function arguments) using a bitmap font in the overlay plane | inc.c |
| CreateIncDisplayLists | Calls functions to create polygon display lists for the graphics of the pitch, roll and yaw gauges - side, top and rear views of the model type | inc.c |
| pitch_gauge | Draws the animated parts of a model pitch dial gauge with warning levels and the gauge value with units of degrees in the normal plane | inc.c |
| pitch_overlay | Draws the pitch dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | inc.c |
| roll_gauge | Draws the animated parts of a model roll dial gauge with warning levels and the gauge value with units of degrees in the normal plane | inc.c |
| roll_overlay | Draws the roll dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | inc.c |

| | | |
|---|---|---|
| yaw_gauge | Draws the animated parts of a model yaw dial gauge with warning levels and the gauge value with units of degrees in the normal plane | inc.c |
| yaw_overlay | Draws the yaw dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | inc.c |
| BitmapStrLen | Calculates the length in pixels of a string written with a GLUT bitmap font | monfrc.c |
| CalculateAlphaBeta | Calculates and sets alpha and beta values from theta, phi inputs | monfrc.c |
| CreatePolygonList | Creates a display list using the input array of (x,y) points to form a smooth shaded polygon using GLUT routines | monfrc.c |
| display | Draws on the screen all that is required in the "normal" plane | monfrc.c |
| drawOverlay | Draws on the screen all that is required in the "overlay" plane | monfrc.c |
| FlashGaugeAlarm | Flashes a red rectangle with vertices defined by the function arguments | monfrc.c |
| Init | Initialises GLUT lighting and colour conditions | monfrc.c |
| main | Main function for MONFRC | monfrc.c |
| output | Outputs message using the GLUT bitmap font specified, starting at location (x,y) | monfrc.c |
| Reshape | Updates the normal and overlay plane viewports and determines the coordinate system | monfrc.c |
| showMessage | Outputs message to the screen using the GLUT stroke font and the scale specified, starting at a location (x,y,z) | monfrc.c |
| StrokeStrLen | Calculates the length in pixels of a string written with a GLUT stroke font | monfrc.c |
| update | Acquires and converts the wind tunnel data to be displayed on the gauges and initiates a redraw of the display | monfrc.c |
| CalculateSGLoadsAndPercs | Calculates strain gauge balance loads and percentages of safe loads using data from the configuration file and strain gauge values | sgs.c |

| | | |
|---|---|---|
| sg_gauge | Draws, in the normal plane, the animated parts of a bar gauge for a single strain gauge channel. The text values of the voltage and the balance load (lb/lbft) are also displayed. | sgs.c |
| sg_overlay1 | Draws the information required in the overlay plane common to a group of strain gauge channels including the gauge markings, scale and labels | sgs.c |
| sg_overlay2 | Draws the information required in the overlay plane for each individual strain gauge channel including the title and warning level indicator | sgs.c |

## C.2. MONFRC Software Function Summaries

| *FUNCTION* | **act_gauge** | |
|---|---|---|
| *PURPOSE* | Draws the actuator graphic (if defined), and the actuator angle in degrees, according to the actuator initialisation file | |
| *SYNTAX* | `void act_gauge(ActDataPtr adp);` | |
| | `ActDataPtr adp;` | Pointer to a structure containing information about actuators |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "acts.h"`<br>`#include "act_cntrl.h"` | |
| *DESCRIPTION* | This function writes an actuator value in degrees in the normal plane for each valid actuator channel specified in the actuator initialisation file. If the model type is a PC9, the appropriate graphics for a rudder and elevator are also drawn. | |

| *FUNCTION* | **act_overlay** | |
|---|---|---|
| *PURPOSE* | Draws the actuator description using a bitmap font in the overlay plane | |
| *SYNTAX* | `void act_overlay(ActDataPtr adp);` | |
| | `ActDataPtr adp;` | Pointer to a structure containing information about actuators |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "acts.h"`<br>`#include "act_cntrl.h"` | |
| *DESCRIPTION* | This function obtains the actuator descriptions for all valid actuator channels from the actuator initialisation file and prints them in the overlay plane in a bitmap font. | |

| *FUNCTION* | **CreateActDisplayLists** |
|---|---|
| *PURPOSE* | Calls functions to create polygon display lists for any actuator graphics |
| *SYNTAX* | `void CreateActDisplayLists();` |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "acts.h"` |
| *DESCRIPTION* | This function creates polygon display lists for any actuator graphics. Each graphic is defined by an array of points in this file and the display list created is named as a member of an ENUM list in `monfrc.h`. |

| FUNCTION | DrawElevatorGraphic | |
|---|---|---|
| PURPOSE | Draws a graphic of a PC9 tail with a moving elevator actuator | |
| SYNTAX | `void DrawElevatorGraphic(float ele_value);` | |
| | `float ele_value;` | Elevator angle in degrees |
| INCLUDES | `#include "monfrc.h"`<br>`#include "acts.h"` | |
| DESCRIPTION | This function calls the display list ELEVATOR to draw a PC9 tail section with a moving elevator graphic in the normal plane. | |

| FUNCTION | DrawRudderGraphic | |
|---|---|---|
| PURPOSE | Draws a graphic of a PC9 tail with a moving rudder actuator | |
| SYNTAX | `void DrawRudderGraphic(float rud_value);` | |
| | `float rud_value;` | Rudder angle in degrees |
| INCLUDES | `#include "monfrc.h"`<br>`#include "acts.h"` | |
| DESCRIPTION | This function calls the display list RUDDER to draw a PC9 tail section with a moving rudder graphic in the normal plane. | |

| FUNCTION | CreateAuxDisplayLists |
|---|---|
| PURPOSE | Calls functions to create polygon display lists for any graphics for the auxiliary module |
| SYNTAX | `void CreateAuxDisplayLists();` |
| INCLUDES | `#include "monfrc.h"`<br>`#include "aux.h"` |
| DESCRIPTION | This function creates polygon display lists of any graphics for the auxiliary module. Each graphic is defined by an array of points in this file and the display list created is named as a member of an ENUM list in `monfrc.h`. At present, only a propeller graphic is available. |

| FUNCTION | rps_gauge | |
|---|---|---|
| PURPOSE | Draws a rotating propeller graphic, rps value and units in the normal plane | |
| SYNTAX | `void rps_gauge(GaugeInfoPtr rps);` | |
| | `GaugeInfoPtr rps;` | Pointer to a structure containing information about RPS gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "aux.h"` | |
| DESCRIPTION | This function calls the display list PROPELLER to draw a rotating propeller with an RPS value drawn in the normal plane. | |

| FUNCTION | rps_overlay | |
|---|---|---|
| PURPOSE | Draws an RPS title using a bitmap font in the overlay plane | |
| SYNTAX | `void rps_overlay(GaugeInfoPtr rps);` | |
| | `GaugeInfoPtr rps;` | Pointer to a structure containing information about RPS gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "aux.h"` | |
| DESCRIPTION | This function draws an RPS title using a bitmap font in the overlay plane. | |

| FUNCTION | bar_gauge | |
|---|---|---|
| PURPOSE | Draws the moving parts of a general graphical bar gauge with warning levels and a parameter value in the normal plane | |
| SYNTAX | `void bar_gauge(float value, GaugeInfoPtr bar);` | |
| | `float value;` | Value of bar gauge parameter |
| | `GaugeInfoPtr bar;` | Pointer to a structure containing information about the gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "bar.h"` | |
| DESCRIPTION | This function draws the moving graphical parts of a general bar gauge and the gauge value in text in the appropriate warning level colour in the normal plane. | |

| FUNCTION | bar_overlay | |
|---|---|---|
| PURPOSE | Draws the bar gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | |
| SYNTAX | `void rps_overlay(GaugeInfoPtr bar);` | |
| | `GaugeInfoPtr bar;` | Pointer to a structure containing information about the gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "bar.h"` | |
| DESCRIPTION | This function draws the bar gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator. | |

| FUNCTION | p_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a mercury barometer gauge and the pressure value with units of kPa in the normal plane | |
| SYNTAX | `void p_gauge(GaugeInfoPtr p);` | |
| | `GaugeInfoPtr p;` | Pointer to a structure containing information about the pressure gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the animated parts of a mercury barometer gauge and the gauge value in text in the normal plane. | |

| FUNCTION | p_overlay | |
|---|---|---|
| PURPOSE | Draws the mercury barometer gauge information required in the overlay plane including the gauge title, markings and scale | |
| SYNTAX | `void p_overlay(GaugeInfoPtr p);` | |
| | `GaugeInfoPtr p;` | Pointer to a structure containing information about the pressure gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the mercury barometer gauge information required in the overlay plane including the gauge title, markings and scale. Presently, only a final alarm is associated with this gauge. | |

| FUNCTION | t_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a temperature gauge (mercury thermometer) and the temperature value with units of degrees C in the normal plane | |
| SYNTAX | `void t_gauge(GaugeInfoPtr t);` | |
| | `GaugeInfoPtr t;` | Pointer to a structure containing information about the temperature gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the animated parts of a mercury thermometer gauge and the gauge value in text in the normal plane. | |

| FUNCTION | t_overlay | |
|---|---|---|
| PURPOSE | Draws the temperature gauge information required in the overlay plane including the gauge title, markings and scale | |
| SYNTAX | `void t_overlay(GaugeInfoPtr t);` | |
| | `GaugeInfoPtr t;` | Pointer to a structure containing information about the temperature gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the thermometer gauge information required in the overlay plane including the gauge title, markings and scale. Presently, only a final alarm is associated with this gauge. | |

| FUNCTION | v_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a velocity dial gauge with warning levels and the gauge value in m/s in the normal plane | |
| SYNTAX | `void v_gauge(GaugeInfoPtr v);` | |
| | `GaugeInfoPtr v;` | Pointer to a structure containing information about the velocity dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the animated parts of a velocity dial gauge and displays the gauge value as text in the normal plane. The sector swept out by the gauge needle is of a solid colour associated with the warning level. | |

| FUNCTION | v_overlay | |
|---|---|---|
| PURPOSE | Draws the velocity dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | |
| SYNTAX | `void v_overlay(GaugeInfoPtr v);` | |
| | `GaugeInfoPtr v;` | Pointer to a structure containing information about the velocity dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "fs.h"` | |
| DESCRIPTION | This function draws the velocity dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator. | |

| FUNCTION | angle_gauge | |
|---|---|---|
| PURPOSE | Draws the text value of another model angle (defined by the function arguments) with units of degrees in the normal plane (no graphic) | |
| SYNTAX | `void angle_gauge(float angle_value, GaugeInfoPtr angle);` | |
| | `float angle_value;` | Value of angle in degrees |
| | `GaugeInfoPtr angle;` | Pointer to a structure containing information about the angle gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws just the text value of another model angle (defined by the function arguments) in the normal plane. No graphic is associated with this gauge. No warning levels are associated with this gauge. | |

| FUNCTION | angle_overlay | |
|---|---|---|
| PURPOSE | Draws the title (or description) of another model angle (defined by the function arguments) using a bitmap font in the overlay plane | |
| SYNTAX | `void angle_overlay(GaugeInfoPtr angle);` | |
| | `GaugeInfoPtr angle;` | Pointer to a structure containing information about the angle gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the title of another model angle (defined by the function arguments) in the overlay plane. | |

| FUNCTION | CreateIncDisplayLists |
|---|---|
| PURPOSE | Calls functions to create polygon display lists for the graphics of the pitch, roll and yaw gauges – side, top and rear views of the model type |
| SYNTAX | `void CreateIncDisplayLists();` |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` |
| DESCRIPTION | This function creates polygon display lists of the graphics in the pitch, roll and yaw gauges – side, top and rear views of the model type. Each graphic is defined by an array of points in this file and the display list created is named as a member of an ENUM list in `monfrc.h`. |

| FUNCTION | pitch_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a model pitch dial gauge with warning levels and the gauge value with units of degrees in the normal plane | |
| SYNTAX | `void pitch_gauge(GaugeInfoPtr pitch);` | |
| | `GaugeInfoPtr pitch;` | Pointer to a structure containing information about the pitch dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the animated parts of a pitch dial gauge and the gauge value in text in the normal plane. A side view graphic of the wind tunnel model is displayed with the appropriate pitch angle at the centre of the gauge. The colours of this graphic and the text value are associated with the warning level. | |

| FUNCTION | pitch_overlay | |
|---|---|---|
| PURPOSE | Draws the pitch dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | |
| SYNTAX | `void pitch_overlay(GaugeInfoPtr pitch);` | |
| | `GaugeInfoPtr pitch;` | Pointer to a structure containing information about the pitch dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the pitch dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator. | |

| FUNCTION | roll_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a model roll dial gauge with warning levels and the gauge value with units of degrees in the normal plane | |
| SYNTAX | `void roll_gauge(GaugeInfoPtr roll);` | |
| | `GaugeInfoPtr roll;` | Pointer to a structure containing information about the roll dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the animated parts of a roll dial gauge and the gauge value in text in the normal plane. A rear view graphic of the wind tunnel model is displayed with the appropriate roll angle at the centre of the gauge. The colours of this graphic and the text value are associated with the warning level. | |

| FUNCTION | roll_overlay | |
|---|---|---|
| PURPOSE | Draws the roll dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | |
| SYNTAX | `void roll_overlay(GaugeInfoPtr roll);` | |
| | `GaugeInfoPtr roll;` | Pointer to a structure containing information about the roll dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the roll dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator. | |

| FUNCTION | yaw_gauge | |
|---|---|---|
| PURPOSE | Draws the animated parts of a model yaw dial gauge with warning levels and the gauge value with units of degrees in the normal plane | |
| SYNTAX | `void yaw_gauge(GaugeInfoPtr yaw);` | |
| | `GaugeInfoPtr yaw;` | Pointer to a structure containing information about the yaw dial gauge |
| INCLUDES | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| DESCRIPTION | This function draws the animated parts of a yaw dial gauge and the gauge value in text in the normal plane. A top view graphic of the wind tunnel model is displayed with the appropriate yaw angle at the centre of the gauge. The colours of this graphic and the text value are associated with the warning level. | |

| *FUNCTION* | **yaw_overlay** | |
|---|---|---|
| *PURPOSE* | Draws the yaw dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator | |
| *SYNTAX* | `void yaw_overlay(GaugeInfoPtr yaw);` | |
| | `GaugeInfoPtr yaw;` | Pointer to a structure containing information about the yaw dial gauge |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "inc.h"` | |
| *DESCRIPTION* | This function draws the yaw dial gauge information required in the overlay plane including the gauge title, markings, scale and the warning level indicator. | |

| *FUNCTION* | **BitmapStrLen** | |
|---|---|---|
| *PURPOSE* | Calculates the length in pixels of a string written with a GLUT bitmap font | |
| *SYNTAX* | `int BitmapStrLen(char *s, void *bitmapfont);` | |
| | `char *s;` | String whose length is to be measured |
| | `void *bitmapfont;` | GLUT bitmap font structure |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function calculates the length in pixels of a string written with a GLUT bitmap font. This allows the correct positioning of such a string on the screen. The function returns the length in pixels of the string as an `int`. | |

| *FUNCTION* | **CalculateAlphaBeta** | |
|---|---|---|
| *PURPOSE* | Calculates and sets alpha and beta values from theta, phi inputs | |
| *SYNTAX* | `void CalculateAlphaBeta(float theta, float phi, float *alpha, float *beta);` | |
| | `float theta;` | Theta in radians |
| | `float phi;` | Phi in radians |
| | `float *alpha;` | Returned value of Alpha in radians |
| | `float *beta;` | Returned value of Beta in radians |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function simply calculates the aerodynamic angles Alpha and Beta from Theta and Phi assuming Psi = 0 with the equations:<br>$\alpha = \sin^{-1}(\sin\theta\cos\phi)$<br>$\beta = \sin^{-1}(\sin\theta\sin\phi)$<br>where $\alpha$ = Alpha<br>$\beta$ = Beta<br>$\theta$ = Theta<br>$\phi$ = Phi | |

| *FUNCTION* | **CreatePolygonList** | |
|---|---|---|
| *PURPOSE* | Creates a display list using the input array of (x,y) points to form a smooth shaded polygon using GLUT routines | |
| *SYNTAX* | `void CreatePolygonList(float data[][2], unsigned int dataSize, int listname);` | |
| | `float data[][2];` | Array of (x,y) points to form a polygon |
| | `unsigned int *dataSize;` | `sizeof` data |
| | `int listname;` | Integer to identify name of the list being created |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function creates a display list of points defining a polygon for quick drawing of a graphic to the screen. Each graphic is identified by the `listname` integer, which is in an `enum` list called `displayLists` in `"monfrc.h"`. | |

| *FUNCTION* | **display** |
|---|---|
| *PURPOSE* | Draws on the screen all that is required in the "normal" plane |
| *SYNTAX* | `void display(void);` |
| *INCLUDES* | `#include "monfrc.h"` |
| *DESCRIPTION* | This function is the argument for a standard GLUT routine called `glutDisplayFunc`, which calls many routines that draw all that is required in the "normal" plane. The graphics on this plane are redrawn for each screen update. Therefore, any portions of the graphical gauges or text that move or change are drawn in this plane. |

| *FUNCTION* | **drawOverlay** |
|---|---|
| *PURPOSE* | Draws on the screen all that is required in the "overlay" plane |
| *SYNTAX* | `void drawOverlay(void);` |
| *INCLUDES* | `#include "monfrc.h"` |
| *DESCRIPTION* | This function is the argument for a standard GLUT routine called `glutOverlayDisplayFunc`, which involves the drawing of everything on the overlay plane. The graphics on this plane are drawn once when the program is started or when the screen is hidden or obscured and a redraw is required. Therefore, any portions of the graphical gauges that do not change are drawn in this plane including titles and gauge markings. |

| *FUNCTION* | **FlashGaugeAlarm** | |
|---|---|---|
| *PURPOSE* | Flashes a red rectangle with vertices defined by the function arguments | |
| *SYNTAX* | `void FlashGaugeAlarm(float x1, float y1, float x2, float y2);` | |
| | `float x1;` | X coordinate of the first corner of the rectangle |
| | `float y1;` | Y coordinate of the first corner of the rectangle |
| | `float x2;` | X coordinate of the second corner of the rectangle, diagonally opposite to the first corner |
| | `float y2;` | Y coordinate of the second corner of the rectangle, diagonally opposite to the first corner |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This is a simple function to flash a red rectangle on the screen as the background to a gauge for an alarm. It requires a global variable, `static int c`, which is declared outside this function at the top of the `monfrc.c` file. This variable continuously cycles between `-flash` and `+flash` (a #define in `"monfrc.h"`) with every update of the screen performed in the function `void update(void)`. If the variable `c` is positive only then is the red rectangle drawn. This produces the flashing effect. | |

| *FUNCTION* | **Init** |
|---|---|
| *PURPOSE* | Initialises GLUT lighting and colour conditions |
| *SYNTAX* | `void Init(void);` |
| *INCLUDES* | `#include "monfrc.h"` |
| *DESCRIPTION* | This function calls routines from the GLUT/OpenGL libraries to initialise the lighting, colour conditions and shading models for the screen. |

| *FUNCTION* | **main** |
|---|---|
| *PURPOSE* | Main function for MONFRC |
| *SYNTAX* | `int main(int argc, char *argv[]);` |
| *INCLUDES* | `#include "monfrc.h"` |
| *DESCRIPTION* | This function performs several initialisation tasks:<br>1. An attempt to open a connection to the shared memory database is made. If the connection fails an error message appears and the application is terminated.<br>2. If the option `-c` *`config_file.dat`* is specified during startup, this configuration file is used instead of the default *`conf_new.dat`*.<br>3. The contents of the configuration file are read.<br>4. The contents of the MONFRC initialisation file, `monfrc.ini`, are read.<br>5. LSWT Modules are set to streaming mode ON<br>6. Freestream and Inclinometer Modules are initialised, using `initFs` and `initInc`.<br>7. Actuator initialisation is performed if required.<br>8. Model attitude and orientation gauge data is set according to the configuration file if necessary.<br>9. The display window size and other characteristics are initialised.<br>10. Display lists are created for the graphics of the actuator, model attitude and orientation and auxiliary gauges.<br>11. The callbacks, `Reshape`, `display` and `update` are established.<br>12. An attempt to establish an overlay plane is made. If this is successful, colour mapping for the overlay plane is performed and a callback for the overlay display, `drawOverlay`, is established.<br>13. The main loop is entered. |

| *FUNCTION* | **output** | |
|---|---|---|
| *PURPOSE* | Outputs message using the GLUT bitmap font specified, starting at location (x,y) | |
| *SYNTAX* | `void output(int x, int y, char *string, void *bitmapfont);` | |
| | `int x;` | Starting X position |
| | `int y;` | Starting Y position |
| | `char *string;` | String to be displayed as output |
| | `void *bitmapfont;` | GLUT bitmap font structure |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function outputs to the screen starting from a position (x,y) a string in a GLUT bitmap font | |

| *FUNCTION* | **Reshape** | |
|---|---|---|
| *PURPOSE* | Updates the normal and overlay plane viewports and determines the coordinate system | |
| *SYNTAX* | `void Reshape(int width, int height);` | |
| | `int width;` | Width of viewport |
| | `int height;` | Height of viewport |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function is the argument for a standard GLUT routine called `glutReshapeFunc`, and sets the viewport of the normal and overlay planes to be the size of the entire window. It also sets a projection matrix such that drawing is performed in an orthographic system with window-relative coordinates and an origin positioned in the lower left corner. | |

| *FUNCTION* | **showMessage** | |
|---|---|---|
| *PURPOSE* | Outputs message to the screen using the GLUT stroke font and the scale specified, starting at a location (x,y,z) | |
| *SYNTAX* | `void showMessage(float x, float y, float z, float scale, char *message, void *strokefont);` | |
| | `float x;` | Starting Y position |
| | `float y;` | Starting Y position |
| | `float x;` | Starting Z position |
| | `float scale;` | Scale factor of the stroke font |
| | `char *message;` | String to be shown on the screen |
| | `void *strokefont` | GLUT stroke font structure. |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function displays on the screen starting from a position (x,y,z) a string in a GLUT stroke font with the scale specified | |

| *FUNCTION* | **StrokeStrLen** | |
|---|---|---|
| *PURPOSE* | Calculates the length in pixels of a string written with a GLUT stroke font | |
| *SYNTAX* | `int StrokeStrLen(char *s, void *strokefont, float scale);` | |
| | `char *s;` | String whose length is to be measured |
| | `void *strokefont;` | GLUT stroke font structure |
| | `float scale;` | Scale factor of the font |
| *INCLUDES* | `#include "monfrc.h"` | |
| *DESCRIPTION* | This function calculates the length in pixels of a string written with a GLUT stroke font. This allows the correct positioning of such a string on the screen. The function returns the length in pixels of the string as an `int`. | |

| *FUNCTION* | **update** |
|---|---|
| *PURPOSE* | Acquires and converts the wind tunnel data to be displayed on the gauges and initiates a redraw of the display |
| *SYNTAX* | `void update(void);` |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "DataAcqFuncs.h"`<br>`#include "act_cntrl.h"` |
| *DESCRIPTION* | This function is the argument for a standard GLUT routine called `glutIdleFunc`, and is continuously called during any idle CPU time. During this function call, a counter is incremented between `-flash` and `+flash` for the purpose of gauge alarms as described in the function `FlashGaugeAlarm`. It then acquires wind tunnel information from the shared memory database and converts it to engineering units. Appropriate model attitude and orientation angles are calculated as are strain gauge loads and percentages. By putting a `glutPostRedisplay` command in this function, the `display` function is recalled, which performs a screen update and redraws all that is on the normal plane. This creates the animated effect of the gauges. |

| *FUNCTION* | **CalculateSGLoadsAndPercs** | |
|---|---|---|
| *PURPOSE* | Calculates strain gauge balance loads and percentages of safe loads using data from the configuration file and strain gauge values | |
| *SYNTAX* | `void CalculateSGLoadsAndPercs(ConfigDataPtr cdp, ZeroDataPtr zdp, float sg_value[6], float sg_load[6], float sg_perc[6]);` | |
| | `ConfigDataPtr cdp;` | Pointer to a structure containing configuration data for the wind tunnel test |
| | `ZeroDataPtr zdp;` | Pointer to a structure containing first and final zeros information |
| | `float sg_value[6];` | Strain Gauge voltages in volts |
| | `float sg_load[6];` | Strain Gauge balance loads in lb/lbft |
| | `float sg_perc[6];` | Loads as a percentage of the balance safe loads |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "sgs.h"` | |
| *DESCRIPTION* | This function calculates the strain gauge balance loads and percentages of safe loads using data from the configuration file and strain gauge values. The function `balred` is called which calculates the balance loads using the calibration matrices in the configuration file. The safeloads in the configuration file are used to calculate the percentages. | |

| FUNCTION | sg_gauge | |
|---|---|---|
| PURPOSE | Draws, in the normal plane, the animated parts of a bar gauge for a single strain gauge channel. The text values of the voltage and the balance load (lb/lbft) are also displayed. | |
| SYNTAX | `void sg_gauge(int ch, float sg_value, float sg_load, float sg_perc, GaugeInfoPtr sg);` | |
| | `int ch;` | Channel number |
| | `float sg_value;` | Strain Gauge voltage (Volts) |
| | `float sg_load;` | Strain Gauge balance load (lb/lbft) |
| | `float sg_perc;` | Load as percentage of balance safe loads |
| | `GaugeInfoPtr sg;` | Pointer to a structure containing information about the strain gauges |
| INCLUDES | `#include "monfrc.h"`<br>`#include "sgs.h"` | |
| DESCRIPTION | This function draws, in the normal plane, the animated parts of a bar gauge for a single strain gauge channel. The gauge value is the percentage of the balance safe load. The text values of the voltage and the balance load (lb/lbft) are also displayed. The colour of the bar and text values are associated with the warning levels. If a strain gauge amplifier overloads (10 Volts) an overload (O/L) message appears in red under the gauge. | |

| FUNCTION | sg_overlay1 | |
|---|---|---|
| PURPOSE | Draws the information required in the overlay plane common to a group of strain gauge channels including the gauge markings, scale and labels | |
| SYNTAX | `void sg_overlay1(GaugeInfoPtr sg);` | |
| | `GaugeInfoPtr sg;` | Pointer to a structure containing information about the strain gauges |
| INCLUDES | `#include "monfrc.h"`<br>`#include "sgs.h"` | |
| DESCRIPTION | This function draws the information required in the overlay plane common to a group of strain gauge channels including the gauge markings, scale and the labels on the first gauge only. | |

| *FUNCTION* | **sg_overlay2** | |
|---|---|---|
| *PURPOSE* | Draws the information required in the overlay plane for each individual strain gauge channel including the title and warning level indicator | |
| *SYNTAX* | `void sg_overlay2(char *title, GaugeInfoPtr sg);` | |
| | `char *title;` | Individual title for the strain gauge channel |
| | `GaugeInfoPtr sg;` | Pointer to a structure containing information about the strain gauges |
| *INCLUDES* | `#include "monfrc.h"`<br>`#include "sgs.h"` | |
| *DESCRIPTION* | This function draws the information required in the overlay plane for each individual strain gauge channel including the title and warning level indicator. | |

# Appendix D: CALIB Software Functions

## D.1. CALIB Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| buttonCB | Callback function for the 'Select Model' button | callback.c |
| button2CB | Callback function for the 'Select data input file' button | callback.c |
| button3CB | Callback function for the 'Select data output file' button | callback.c |
| button_goCB | Callback function for the 'button_go' button (Execute Button) in FORM6 | callback.c |
| button_quitCB | Callback function for the 'button_quit' button (Quit Button) in FORM6 | callback.c |
| changeCB1_1 | Callback function for the toggle button (Multivariable Regression) in FORM2 | callback.c |
| changeCB1_2 | Callback function for the toggle button (Ramaswamy's Least Squares Method) in FORM2 | callback.c |
| changeCB2_1 | Callback function for the toggle button (No Optimisation) in FORM4 | callback.c |
| changeCB2_2 | Callback function for the toggle button (1se Optimisation) in FORM4 | callback.c |
| changeCB2_3 | Callback function for the toggle button (2se Optimisation) in FORM4 | callback.c |
| changeCB2_4 | Callback function for the toggle button (3se Optimisation) in FORM4 | callback.c |
| changeCB3_1 | Callback function for the toggle button (Activate reverse optimisation) in FORM5 | callback.c |
| changeCB3_2 | Callback function for the toggle button (De-activate reverse optimisation) in FORM5 | callback.c |
| dialogCB | Popup dialog list for calibration model selection | callback.c |
| fdialog1CB | Callback function for the 'fdialog1' file selection dialog box in FORM1 | callback.c |
| fdialog2CB | Callback function for the 'fdialog2' file selection dialog box in FORM1 | callback.c |
| text1_1CB | Callback function for the 'text1_1' text box ('Zero' filter range [%]) in FORM1 | callback.c |

| | | |
|---|---|---|
| text2CB | Callback function for the 'text2' text box in FORM3 | callback.c |
| text3CB | Callback function for the 'text3' text box in FORM3 | callback.c |
| toggle1_1 | Callback function for the 'toggle1_1' toggle button (Activate 'zero' data points filter) in FORM1 | callback.c |
| toggle7_1 | Callback function for the toggle button 'toggle7_1' (Activate Chauvenet's Criterion) in FORM7 | callback.c |
| toggleCB | Callback function for the toggle button (Tolerances in R and H) in FORM3 | callback.c |
| chauvenet | Performs Chauvenet's Criterion on a set of data | chauvenet.c |
| coeff | Generate an output file which contains the result obtained by CALIB | coeff.c |
| convert5to6 | Convert a 5 components coefficient matrix to a 6 components coefficient matrix | convert5to6.c |
| dataout | Output a text file which contains the calibration data set which will be used by CALIB | dataout.c |
| filter | Performs zero filtering procedure to eliminate close to zero values from the original calibration data set. | filter.c |
| gaussj | Performs Gauss-Jordan elimination with full pivoting | gaussj.c |
| leastsquare1 | Calculate the balance calibration coefficient matrix using the multivariable regression least squares method. | leastsquare1.c |
| leastsquare2_1 | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R-H] using the Ramaswamy least squares method. | leastsquare2_1.c |
| leastsquare2_2 | Calculate the balance calibration coefficient matrix for the calibration model: [R]=[C][H] using the Ramaswamy least squares method. | leastsquare2_2.c |
| leastsquare2_3 | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R] using the Ramaswamy least squares method. | leastsquare2_3.c |
| optimise | Eliminate any outliers defined by the user from the original calibration data set. | optimise.c |
| rev_calib1 | Performs reverse calibration on calibration model: [H]=[C][R-H]. | rev_calib1.c |
| rev_calib2 | Performs reverse calibration on calibration model: [R]=[C][H]. | rev_calib2.c |

| | | |
|---|---|---|
| rev_calib3 | Performs reverse calibration on calibration model: [H]=[C][R]. | rev_calib3.c |
| rfile | Reads the data input file and the balance load range file | rfile.c |
| rfile2 | Reads the balance design load range from the input data file (des_load.dat) | rfile2.c |
| RR_model1 | Generates RR2 matrix for second and third order calibration equations for the calibration model: [H]=[C][R-H] | RR_model1.c |
| RR_model2 | Generates RR2 matrix for second and third order calibration equations for the calibration model: [R]=[C][H] | RR_model2.c |
| RR_model3 | Generates RR2 matrix for second and third order calibration equations for the calibration model: [H]=[C][R] | RR_model3.c |
| statistic | Calculates the standard errors and the coefficient of multiple correlation for each component of the strain gauge balance described by the balance calibration equation | statistic.c |

## D.2. CALIB Software Function Summaries

| *FUNCTION* | **buttonCB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'Select Model' button | |
| *SYNTAX* | `void buttonCB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmPushButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'Select Model' button in the GUI interface | |

| *FUNCTION* | **button2CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'Select data input file' button | |
| *SYNTAX* | `void button2CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmPushButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'Select data input file' button in the GUI interface | |

| *FUNCTION* | **button3CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'Select data output file' button | |
| *SYNTAX* | `void button3CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmPushButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'Select data output file' button in the GUI interface | |

| *FUNCTION* | **button_goCB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'button_go' button (Execute Button) in FORM6 | |
| *SYNTAX* | `void button_goCB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmPushButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'button_go' button (Execute Button) in the GUI interface. This function executes various functions in the program based on the user's selection in the GUI interface. | |

| *FUNCTION* | **button_quitCB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'button_quit' button (Quit Button) in FORM6 | |
| *SYNTAX* | `void button_quitCB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmPushButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'button_quit' button (Quit Button) in the GUI interface. This function quit the program. | |

| *FUNCTION* | **changeCB1_1** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (Multivariable Regression) in FORM2 | |
| *SYNTAX* | `void changeCB1_1(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (Multivariable Regression) in the GUI interface | |

| *FUNCTION* | **changeCB1_2** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (Ramaswamy's Least Squares Method) in FORM2 | |
| *SYNTAX* | `void changeCB1_2(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (Ramaswamy's Least Squares Method) in the GUI interface | |

| *FUNCTION* | **changeCB2_1** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (No Optimisation) in FORM4 | |
| *SYNTAX* | `void changeCB2_1(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (No Optimisation) in the GUI interface | |

| *FUNCTION* | **changeCB2_2** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (1se Optimisation) in FORM4 | |
| *SYNTAX* | `void changeCB2_2(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (1se Optimisation) in the GUI interface | |

| *FUNCTION* | **changeCB2_3** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (2se Optimisation) in FORM4 | |
| *SYNTAX* | `void changeCB2_3(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (2se Optimisation) in the GUI interface | |

| *FUNCTION* | **changeCB2_4** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (3se Optimisation) in FORM4 | |
| *SYNTAX* | `void changeCB2_4(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (3se Optimisation) in the GUI interface | |

| *FUNCTION* | **changeCB3_1** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (Activate reverse optimisation) in FORM5 | |
| *SYNTAX* | `void changeCB3_1(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (Activate reverse optimisation) in the GUI interface | |

| *FUNCTION* | **changeCB3_2** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (De-activate reverse optimisation) in FORM5 | |
| *SYNTAX* | `void changeCB3_2(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (De-activate reverse optimisation) in the GUI interface | |

| *FUNCTION* | **dialogCB** | |
|---|---|---|
| *PURPOSE* | Popup dialog list for calibration model selection | |
| *SYNTAX* | `void dialogCB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmSelectionBoxCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Construct a popup list for calibration model selection. The popup list contains all the calibration equations available in the program for analysis. | |

| *FUNCTION* | **fdialog1CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'fdialog1' file selection dialog box in FORM1 | |
| *SYNTAX* | `void fdialog1CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmSelectionBoxCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'fdialog1' file selection dialog box in the GUI interface | |

| *FUNCTION* | **fdialog2CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'fdialog2' file selection dialog box in FORM1 | |
| *SYNTAX* | `void fdialog2CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmSelectionBoxCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'fdialog2' file selection dialog box in the GUI interface | |

| *FUNCTION* | **text1_1CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'text1_1' text box ('Zero' filter range [%]) in FORM1 | |
| *SYNTAX* | `void text1_1CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XtPointer call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'text1_1' text box ('Zero' filter range [%]) in the GUI interface | |

| *FUNCTION* | **text2CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'text2' text box in FORM3 | |
| *SYNTAX* | `void text2CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XtPointer call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'text2' text box in the GUI interface | |

| *FUNCTION* | **text3CB** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'text3' text box in FORM3 | |
| *SYNTAX* | `void text3CB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XtPointer call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'text3' text box in the GUI interface | |

| *FUNCTION* | **toggle1_1** | |
|---|---|---|
| *PURPOSE* | Callback function for the 'toggle1_1' toggle button (Activate 'zero' data points filter) in FORM1 | |
| *SYNTAX* | `void toggle1_1(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the 'toggle1_1' toggle button (Activate 'zero' data points filter) in the GUI interface | |

| *FUNCTION* | **toggle7_1** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button 'toggle7_1' (Activate Chauvenet's Criterion) in FORM7 | |
| *SYNTAX* | `void toggle7_1(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button 'toggle7_1' (Activate Chauvenet's Criterion) in the GUI interface | |

| *FUNCTION* | **toggleCB** | |
|---|---|---|
| *PURPOSE* | Callback function for the toggle button (Tolerances in R and H) in FORM3 | |
| *SYNTAX* | `void toggleCB(w, client_data, call_data)` | |
| | `Widget w` | Parent widget ID |
| | `CALIB *client_data;` | A structure which contains the variables used to define the dialog list |
| | `XmToggleButtonCallbackStruct *call_data` | Specialised structure with information useful to the function |
| *INCLUDES* | `#include <Xm/Xm.h`<br>`#include <Xm/Form.h`<br>`#include <Xm/Label.h`<br>`#include <Xm/PushB.h`<br>`#include <Xm/SelectionB.h`<br>`#include <Xm/List.h`<br>`#include <Xm/RowColumn.h`<br>`#include <Xm/ToggleB.h`<br>`#include <Xm/Frame.h`<br>`#include <Xm/Text.h`<br>`#include <Xm/Separator.h`<br>`#include <Xm/FileSB.h`<br>`#include <Xm/MessageB.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "calib_function.h"` | |
| *DESCRIPTION* | Provides callback functionality to the toggle button (Tolerances in R and H) in the GUI interface | |

| *FUNCTION* | **chauvenet** | |
|---|---|---|
| *PURPOSE* | Performs Chauvenet's Criterion on a set of data | |
| *SYNTAX* | `void chauvenet(calibptr)` | |
| | `CALIB *calibptr` | Structure list which contains all variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Performs Chauvenet's Criterion on a set of data. A *N=5* Chauvenet's Criterion is implemented in this function. | |

| *FUNCTION* | **coeff** | |
|---|---|---|
| *PURPOSE* | Generate an output file which contains the result obtained by CALIB | |
| *SYNTAX* | `void coeff(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Generate an output file that contains the result obtained by CALIB. The output file is in ASCII text format which contains the followings:<br>• Balance calibration model<br>• Balance calibration equation<br>• Number of coefficients in the calibration equation<br>• Mathematical regression model used<br>• Tolerance in the original [H] measurements<br>• Tolerance in the original [R] measurements<br>• Original number of data set in the data input file<br>• Number of data set used for optimised calibration matrix calculation<br>• Number of data set eliminated by the optimisation routine<br>• The kind of optimisation technique used in optimising the data (standard error optimisation / Chauvenet's Criterion optimisation)<br>• Balance calibration coefficients matrix<br>• Optimised calibration coefficients matrix<br>• Normalised balance calibration matrix<br>• Sensitivity matrix<br>• Standard errors for each balance component<br>• Multiple correlation for each component | |

| *FUNCTION* | **convert5to6** | |
|---|---|---|
| *PURPOSE* | Convert a 5 components coefficient matrix to a 6 components coefficient matrix | |
| *SYNTAX* | `void convert5to6(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Convert a 5 components coefficient matrix to a 6 components coefficient matrix. This function enable CALIB to perform analysis on 5 component strain gauge balance, such as the one used in the transonic wind tunnel. | |

| *FUNCTION* | **dataout** | |
|---|---|---|
| *PURPOSE* | Output a text file which contains the calibration data set which will be used by CALIB | |
| *SYNTAX* | `void dataout(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"` | |
| *DESCRIPTION* | Output an ASCII text file that contains the calibration data set, which is read into the computer memory by the function *rfile(calibptr)*. The purpose of this function is to allow the end user to make sure what is being analysed by the program is what is in the original calibration data file. | |

| FUNCTION | filter | |
|---|---|---|
| PURPOSE | Performs zero filtering procedure to eliminate close to zero values from the original calibration data set. | |
| SYNTAX | `void filter(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Performs zero filtering procedure to eliminate close to zero values from the original calibration data set. The definition of close to zero value can be defined by the user during run-time through the GUI interface. | |

| FUNCTION | gaussj | |
|---|---|---|
| PURPOSE | Performs Gauss-Jordan elimination with full pivoting | |
| SYNTAX | `void gaussj(double **a, int n, double **b, int m)` | |
| | `double **a` | Input matrix |
| | `int n` | Number of row and column of the input matrix |
| | `double **b` | Output matrix (inverted matrix) |
| | `int m` | Number of right-hand side vectors |
| INCLUDES | `#include <stdio.h`<br>`#include <math.h`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Performs Gauss-Jordan elimination with full pivoting. (Refer to Numerical Recipes in C, Chapter 2) | |

| FUNCTION | leastsquare1 | |
|---|---|---|
| PURPOSE | Calculate the balance calibration coefficient matrix using the multivariable regression least squares method. | |
| SYNTAX | `void leastsquare1(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <stddef.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Calculate the balance calibration coefficient matrix using the multivariable regression least squares method. | |

| FUNCTION | leastsquare2_1 | |
|---|---|---|
| PURPOSE | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R-H] using the Ramaswamy least squares method. | |
| SYNTAX | `void leastsquare2_1(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R-H] using the Ramaswamy least squares method. | |

| FUNCTION | leastsquare2_2 | |
|---|---|---|
| PURPOSE | Calculate the balance calibration coefficient matrix for the calibration model: [R]=[C][H] using the Ramaswamy least squares method. | |
| SYNTAX | `void leastsquare2_2(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Calculate the balance calibration coefficient matrix for the calibration model: [R]=[C][H] using the Ramaswamy least squares method. | |

| FUNCTION | leastsquare2_3 | |
|---|---|---|
| PURPOSE | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R] using the Ramaswamy least squares method. | |
| SYNTAX | `void leastsquare2_3(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Calculate the balance calibration coefficient matrix for the calibration model: [H]=[C][R] using the Ramaswamy least squares method. | |

| *FUNCTION* | **optimise** | |
|---|---|---|
| *PURPOSE* | Eliminate any outliers defined by the user from the original calibration data set. | |
| *SYNTAX* | `void optimise(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Eliminate any outliers defined by the user from the original calibration data set. Outliers are defined by either the standard error optimisation techniques or the Chauvenet's Criterion optimisation technique. | |

| *FUNCTION* | **rev_calib1** | |
|---|---|---|
| *PURPOSE* | Performs reverse calibration on calibration model: [H]=[C][R-H]. | |
| *SYNTAX* | `void rev_calib1(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Performs reverse calibration on calibration model: [H]=[C][R-H]. This function uses a iterative reverse calibration procedures to obtain the solutions. | |

| FUNCTION | rev_calib2 | |
|---|---|---|
| PURPOSE | Performs reverse calibration on calibration model: [R]=[C][H]. | |
| SYNTAX | `void rev_calib2(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Performs reverse calibration on calibration model: [R]=[C][H]. This function uses a iterative reverse calibration procedures to obtain the solutions. | |

| FUNCTION | rev_calib3 | |
|---|---|---|
| PURPOSE | Performs reverse calibration on calibration model: [H]=[C][R]. | |
| SYNTAX | `void rev_calib13calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Performs reverse calibration on calibration model: [H]=[C][R]. This function uses a direct (non-iterative) reverse calibration procedures to obtain the solutions. | |

| FUNCTION | rfile | |
|---|---|---|
| PURPOSE | Reads the data input file and the balance load range file | |
| SYNTAX | `void rfile(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <stddef.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Reads the data input file and the balance load range file. It introduces a non-zero constant, called TINY (1e-307) to all data points equal to zero. This will eliminate any possibility of getting a floating point error (divided by zero) during run-time. | |

| FUNCTION | rfile2 | |
|---|---|---|
| PURPOSE | Reads the balance design load range from the input data file (des_load.dat) | |
| SYNTAX | `void rfile2(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <stddef.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "variables.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Reads the balance design load range from the input data file (des_load.dat). | |

| *FUNCTION* | **RR_model1** | |
|---|---|---|
| *PURPOSE* | Generates RR2 matrix for second and third order calibration equations for the calibration model: [H]=[C][R-H] | |
| *SYNTAX* | `void RR_model1(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Generates RR2 matrix for the second and third order calibration equations for the calibration model: [H]=[C][R-H]. The RR2 matrix is then use with the least squares regression methods to calculate the balance calibration coefficient matrix. | |

| *FUNCTION* | **RR_model2** | |
|---|---|---|
| *PURPOSE* | Generates RR2 matrix for second and third order calibration equations for the calibration model: [R]=[C][H] | |
| *SYNTAX* | `void RR_model2(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| *INCLUDES* | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "nrutil.h"` | |
| *DESCRIPTION* | Generates RR2 matrix for the second and third order calibration equations for the calibration model: [R]=[C][H]. The RR2 matrix is then use with the least squares regression methods to calculate the balance calibration coefficient matrix. | |

| FUNCTION | RR_model3 | |
|---|---|---|
| PURPOSE | Generates RR2 matrix for second and third order calibration equations for the calibration model: [H]=[C][R] | |
| SYNTAX | `void RR_model3(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Generates RR2 matrix for the second and third order calibration equations for the calibration model: [H]=[C][R]. The RR2 matrix is then use with the least squares regression methods to calculate the balance calibration coefficient matrix. | |

| FUNCTION | statistic | |
|---|---|---|
| PURPOSE | Calculates the standard errors and the coefficient of multiple correlation for each component of the strain gauge balance described by the balance calibration equation. | |
| SYNTAX | `void statistic(calibptr)` | |
| | `CALIB *calibptr` | Structure which contains all the variables used in CALIB |
| INCLUDES | `#include <stdio.h`<br>`#include <stdlib.h`<br>`#include <math.h`<br>`#include <Xm/Xm.h`<br>`#include "structure.h"`<br>`#include "nrutil.h"` | |
| DESCRIPTION | Calculates the standard errors and the coefficient of multiple correlation for each component of the strain gauge balance described by the balance calibration equation. | |

# Appendix E: ACTUATOR Software Functions

## E.1. ACTUATOR Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| Bittest | Bit test | act_cntrl.c |
| CalcLvdt | Converts an Angle to an LVDT reading | act_cntrl.c |
| CalcAngle | Converts LVDT reading to an angle | act_cntrl.c |
| CheckActData | Check for valid actuator data | act_cntrl.c |
| initAct | Reads actuator initialisation file and initialises variables | act_cntrl.c |
| SetUp | Initialises actuators | act_cntrl.c |
| CancelOpenCb | Cancel call back for open file window | actuator.c |
| Init_all | Initialising function for actuators | actuator.c |
| OpenFile | Create file selection dialog box | actuator.c |
| OpenFileCb | Open file call back | actuator.c |
| Quit | Quits program | actuator.c |
| Stop | Stops actuators | actuator.c |
| Update | Update display variables | actuator.c |
| ActCntrlMW_calib | Calibration selection | actuator_stubs.c |
| AcCntrlMW_ExitButton_CB1 | Exit button call back | actuator_stubs.c |
| ActCntrlMW_MoveButton_CB1 | Move actuators | actuator_stubs.c |
| ActCntrlMW_StopButton_CB1 | Stop button call back (calibration window) | actuator_stubs.c |
| Cancel_button_CB1 | 'Cancel' call back in calibration window | actuator_stubs.c |
| CheckNumChar | Checks string for non-numeric characters | actuator_stubs.c |
| MinusButton_CB1 | '-' button call back in calibration window | actuator_stubs.c |
| PlusButton_CB1 | '+' button call back in calibration window | actuator_stubs.c |
| PulseButton_CB1 | Pulse button call back (calibration window) | actuator_stubs.c |
| ReadButton_CB1 | 'Read' button call back in calibration window | actuator_stubs.c |
| RemoveDialButton | Remove button from window | actuator_stubs.c |

| | | |
|---|---|---|
| Reset_ok_CB | ?OK? button call back on ?Reset Warning? popup | actuator_stubs.c |
| Reset_warning | Create pop-up dialog asking if the user wishes to continue with the actuator reset | actuator_stubs.c |
| ResetButton_CB1 | Reset button call back (main window) | actuator_stubs.c |
| RTSetbutt_no | Changes the button_no variable to the selected actuator channel | actuator_stubs.c |
| SecondW_Okbutton | 'OK' call back in calibration window | actuator_stubs.c |
| set_warning | Prints warning message to screen (creates warning dialog window) | actuator_stubs.c |
| StopButton_CB2 | Stop button call back (main window) | actuator_stubs.c |
| Warn_ok_CB1 | 'OK' button call back on warning window | actuator_stubs.c |
| button_create | Creates a button widget | actuator_ui.c |
| cntrlpane_create | Creates control pane widget | actuator_ui.c |
| label_create | Creates a label widget | actuator_ui.c |
| mainwindow_create | Creates main window widgets | actuator_ui.c |
| MainwindowInfo_clear | Clear all information in variable instance | actuator_ui.c |
| menubutton_create | Creates a pull down menu widget | actuator_ui.c |
| menubutton_menu_create | Creates the menu in a pull down menu widget | actuator_ui.c |
| MW_mainwindow_initialise | Initialise and create the main window | actuator_ui.c |
| MW_target_create | Create the target angle widget in the main window | actuator_ui.c |
| panedwin_create | Creates paned window widget | actuator_ui.c |
| secondwindow_create | Creates calibration window widgets | actuator_ui.c |
| Secondwindow_init | Initialise and create the main window | actuator_ui.c |
| SecondwindowInfo_Clear | Clear all information in variable instance | actuator_ui.c |
| TextBox_create | Creates an editable text box widget | actuator_ui.c |
| TextBox2_create | Creates a text box widget | actuator_ui.c |
| spline | Initialise cubic spline (calculate the second derivative for the tabulated data) | cub_spline.f |
| splint | Initialise cubic spline (calculate the second derivative for the tabulated data) | cub_spline.f |

## E.2. ACTUATOR Software Function Summaries

| *FUNCTION* | **Bittest** | |
|---|---|---|
| *PURPOSE* | Bit test | |
| *SYNTAX* | `int bittest(unsigned short int data, int i);` | |
| | `unsigned short int data;` | The variable to be tested |
| | `int i` | The bit number to be tested |
| *RETURN VALUES* | Value of bit number i | |

| *FUNCTION* | **CalcLvdt** | |
|---|---|---|
| *PURPOSE* | Converts an Angle to an LVDT reading | |
| *SYNTAX* | `double CalcLvdt(double Angle, int i)` | |
| | `double Angle;` | Angle |
| | `int i;` | actuator channel |
| *INCLUDES* | `#include "act_cntrl.h"` | |
| *RETURN VALUES* | LVDT required for given angle | |

| *FUNCTION* | **CalcAngle** | |
|---|---|---|
| *PURPOSE* | Converts LVDT reading to an angle | |
| *SYNTAX* | `double CalcAngle(double lvdt, int i)` | |
| | `double lvdt;` | lvdt reading |
| | `int i;` | actuator channel |
| *INCLUDES* | `#include "act_cntrl.h"` | |
| *RETURN VALUES* | Angle obtained from given LVDT reading | |

| FUNCTION | CheckActData | |
|---|---|---|
| PURPOSE | Check for valid actuator data | |
| SYNTAX | `int CheckActData(ActDataPtr adp, double data, int i, int typ)` | |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| | `double data;` | Data to be checked |
| | `int i;` | actuator channel |
| | `int typ;` | type of data (1 if angle, 2 if LVDT) |
| INCLUDES | `#include "act_cntrl.h"` | |
| RETURN VALUES | -2 | Channel number not valid |
| | -1 | Cubic spline not initialised |
| | 0 | Data O.K. |
| | 1 | Data out of range |

| FUNCTION | initAct | |
|---|---|---|
| PURPOSE | Reads actuator initialisation file and initialises variables | |
| SYNTAX | `void initAct(char *filename, ActDataPtr adp);` | |
| | `char *filename;` | Name of actuator initialisation file |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| INCLUDES | `#include "act_cntrl.h"` | |
| DESCRIPTION | Main actuator initialisation function | |

| FUNCTION | SetUp | |
|---|---|---|
| PURPOSE | Initialises actuators | |
| SYNTAX | `int SetUp(char *warnlabel, ActDataPrt adp);` | |
| | `char *warnlabel;` | Warning string if error occurs |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| INCLUDES | `#include "act_cntrl.h"` | |
| DESCRIPTION | If an error occurs when initialising the actuators, the external variable Act_Err is set to 1. | |
| RETURN VALUES | 0 | Actuators initialised |
| | 1 | Actuators failed to initialised |

| *FUNCTION* | **CancelOpenCb** | |
|---|---|---|
| *PURPOSE* | Cancel call back for open file window | |
| *SYNTAX* | `void CancelOpenCb(Widget w, XtPointer cd, XtPointer cb);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer cd;` | NULL |
| | `XtPointer cb` | NULL |
| *DESCRIPTION* | Call back for the cancel button | |

| *FUNCTION* | **Init_all** |
|---|---|
| *PURPOSE* | Initialising function |
| *SYNTAX* | `void Init_all(void);` |
| *DESCRIPTION* | This function is the main initialisation function. It opens communications with the actuators and the shared memory and initialises the windows |

| *FUNCTION* | **OpenFile** | |
|---|---|---|
| *PURPOSE* | Create file selection dialog box | |
| *SYNTAX* | `Widget OpenFile(Widget w, int type);` | |
| | `Widget w;` | Parent widget |
| | `int type` | Not used |
| *RETURN VALUES* | File selection dialog box widget | |
| *DESCRIPTION* | This dialog box is specifically designed to select the actuator initialisation file and is only called if the file name was not given when the program was executed. | |

| FUNCTION | OpenFileCb | |
|---|---|---|
| PURPOSE | Open file call back | |
| SYNTAX | `void OpenFileCb(Widget w, XtPointer cd, XtPointer cb);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer cd;` | Variable type |
| | `XtPointer cb` | Pointer to the file selection call back structure |
| DESCRIPTION | Call back routine when a file is selected. Initialisation is initiated once file is selected. | |

| FUNCTION | Quit | |
|---|---|---|
| PURPOSE | Quits program | |
| SYNTAX | `void Quit(Widget w, XButtonEvent *event, String *args, int *n);` | |
| | `Widget w;` | |
| | `XbuttonEvent *event;` | |
| | `String *args;` | |
| | `int *n;` | |
| DESCRIPTION | This Quit function is activated using the keyboard override system and hence is a callback function with the required variables. | |

| FUNCTION | Stop | |
|---|---|---|
| PURPOSE | Stops actuators | |
| SYNTAX | `void Stop(Widget w, XButtonEvent *event, String *args, int *n);` | |
| | `Widget w;` | |
| | `XbuttonEvent *event;` | |
| | `String *args;` | |
| | `int *n;` | |
| DESCRIPTION | This Stop function is activated using the keyboard override system and hence is a callback function with the required variables. | |

| *FUNCTION* | **Update** | |
|---|---|---|
| *PURPOSE* | Update display variables | |
| *SYNTAX* | `void Update(XtPointer client_data, XtintervalId *id);` | |
| | `XtPointer client_data;` | |
| | `XtintervalId *id;` | |
| *DESCRIPTION* | Updates all actuator variables | |

| *FUNCTION* | **ActCntrlMW_calib** | |
|---|---|---|
| *PURPOSE* | Calibration selection | |
| *SYNTAX* | `void ActCntrlMW_calib(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Opens calibration (manual mode) window with the selected actuator channel. Also closes main window. | |

| *FUNCTION* | **ActCntrlMW_ExitButton_CB1** | |
|---|---|---|
| *PURPOSE* | Exit button call back | |
| *SYNTAX* | `void ActCntrlMW_ExitButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Not used |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Checks for moving actuators before quitting the program. If moving the 'Stop' function is executed and an error message is displayed. | |

| FUNCTION | ActCntrlMW_MoveButton_CB1 | |
|---|---|---|
| PURPOSE | Move actuators | |
| SYNTAX | `void ActCntrlMW_MoveButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Call back routine when move button in the main window is selected. This routine reads the target angles, converts them to required LVDT values for each channel, then sends the appropriate 'Move' command to the actuators. | |

| FUNCTION | ActCntrlMW_StopButton_CB1 | |
|---|---|---|
| PURPOSE | Stop button call back (Calibration window) | |
| SYNTAX | `void ActCntrlMW_StopButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Not used |
| | `XtPointer callData;` | Not used |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Sends manual stop command to actuators | |

| FUNCTION | Cancel_button_CB1 | |
|---|---|---|
| PURPOSE | 'Cancel' call back in calibration window | |
| SYNTAX | `void Cancel_button_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Closes calibration window and opens the main window without saving the new calibration data. | |

| FUNCTION | CheckNumChar | |
|---|---|---|
| PURPOSE | Checks string for non-numeric characters | |
| SYNTAX | `int CheckNumChar(char *Text)` | |
| | `char *Text` | String to check |
| INCLUDES | `#include "actuator_ui.h"` | |
| RETURN VALUES | -1<br>0<br>1 | String contains only null characters<br>String contains only numeric characters<br>String contains non-numeric characters |
| DESCRIPTION | If string contains characters other than the numbers 0 to 9, '-', or '+' function will return a failed condition. | |

| FUNCTION | MinusButton_CB1 | |
|---|---|---|
| PURPOSE | '-' button call back in calibration window | |
| SYNTAX | `void MinusButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Sends manual move command to actuator (negative direction is defined in the initialisation file). If the actuator is in 'continuous' mode all buttons except 'Stop' are made inactive. | |

| *FUNCTION* | **PlusButton_CB1** | |
|---|---|---|
| *PURPOSE* | '+' button call back in calibration window | |
| *SYNTAX* | `void PlusButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Sends manual move command to actuator (positive direction is defined in the initialisation file). If the actuator is in 'continuous' mode all buttons except 'Stop' are made inactive. | |

| *FUNCTION* | **PulseButton_CB** | |
|---|---|---|
| *PURPOSE* | Pulse button call back (calibration window) | |
| *SYNTAX* | `void PulseButton_CB(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Not used |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Swaps between 'Pulse' mode and 'Continuous' mode while in the calibration mode | |

| *FUNCTION* | **ReadButton_CB1** | |
|---|---|---|
| *PURPOSE* | 'Read' button call back in calibration window | |
| *SYNTAX* | `void ReadButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Reads the current LVDT and Target angle in the calibration window and writes the information to a temporary file for later saving. | |

| *FUNCTION* | **RemoveDialButton** | |
|---|---|---|
| *PURPOSE* | Remove button from window | |
| *SYNTAX* | `void RemoveDialButton(Widget w, int which_button);` | |
| | `Widget w;` | Parent widget |
| | `int which_button;` | Button to be removed |
| *INCLUDES* | `#include "actuator_ui.h"` | |

| *FUNCTION* | **Reset_ok_CB** | |
|---|---|---|
| *PURPOSE* | 'OK' button call back on 'Reset Warning' popup | |
| *SYNTAX* | `void Reset_ok_CB(Widget w, XtPointer cd, XtPointer cb)` | |
| | `Widget w` | Parent widget |
| | `XtPointer cd` | Not used |
| | `XtPointer cb` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Closes 'Reset Warning' popup and continues with reset | |

| *FUNCTION* | **Reset_warning** | |
|---|---|---|
| *PURPOSE* | Create pop-up dialog asking if the user wishes to continue with the actuator reset | |
| *SYNTAX* | `void Reset_warning(Widget parent);` | |
| | `Widget parent;` | Parent window |
| *INCLUDES* | `#include "actuator_ui.h"` | |

| *FUNCTION* | **ResetButton_CB1** | |
|---|---|---|
| *PURPOSE* | Reset button call back | |
| *SYNTAX* | `void ResetButton_CB1(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Not used |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Sends 'Reinitialise' command to actuators. Does a similar check to 'Exit' button call back | |

| *FUNCTION* | **RTSetbutt_no** | |
|---|---|---|
| *PURPOSE* | Changes the button_no variable to the selected actuator channel | |
| *SYNTAX* | `void RTSetbutt_no(Widget widget, int i, XtPointer callData);` | |
| | `Widget widget;` | Parent widget |
| | `int i;` | Selected actuator channel |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |

| *FUNCTION* | **SecondW_Okbutton** | |
|---|---|---|
| *PURPOSE* | 'OK' call back in calibration window | |
| *SYNTAX* | `void SecondW_Okbutton(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Pointer to actuator data structure |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Updates initialisation file then closes the calibration window and opens the main window | |

| *FUNCTION* | **set_warning** | |
|---|---|---|
| *PURPOSE* | Prints warning message to screen (creates warning dialog window) | |
| *SYNTAX* | `void set_warning(Widget parent, char *warnlabel);` | |
| | `Widget parent;` | Parent widget |
| | `char *warnlabel` | The string to be printed |
| *INCLUDES* | `#include "actuator_ui.h"` | |

| *FUNCTION* | **StopButton_CB2** | |
|---|---|---|
| *PURPOSE* | Stop button call back (Main window) | |
| *SYNTAX* | `void StopButton_CB2(Widget w, XtPointer clientData, XtPointer callData);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer clientData;` | Not used |
| | `XtPointer callData;` | Not used |
| *INCLUDES* | `#include "actuator_ui.h"` | |
| *DESCRIPTION* | Stop actuators by sending Power Relay Control commands | |

| FUNCTION | Warn_ok_CB1 | |
|---|---|---|
| PURPOSE | 'OK' button call back on warning window | |
| SYNTAX | `void Warn_ok_CB1(Widget w, XtPointer cd, XtPointer cb);` | |
| | `Widget w;` | Parent widget |
| | `XtPointer cd;` | Not used |
| | `XtPointer cb;` | Not used |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Closes the warning window | |

| FUNCTION | button_create | |
|---|---|---|
| PURPOSE | Creates a button widget | |
| SYNTAX | `Widget button_create(Widget parent, char *label, int Nx, int Ny);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | The string written on the button |
| | `int Nx;` | X position of widget |
| | `int Ny;` | Y position of widget |
| RETURN VALUES | Button widget | |
| DESCRIPTION | Variable label is the string written on the button, the widget's label is the variable label with the string "_button" appended to the end. | |

| FUNCTION | cntrlpane_create | |
|---|---|---|
| PURPOSE | Creates control pane widget | |
| SYNTAX | `Widget cntrlpane_create(Widget parent, char *Label);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | Control pane label |
| RETURN VALUES | Control pane widget | |

| *FUNCTION* | **label_create** | |
|---|---|---|
| *PURPOSE* | Creates a label widget | |
| *SYNTAX* | `Widget label_create(Widget parent, char *label, int Nx, int Ny);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | The string to be written |
| | `int Nx;` | X position of widget |
| | `int Ny;` | Y position of widget |
| *RETURN VALUES* | Label widget | |
| *DESCRIPTION* | Variable label is the string written to the screen, the widget's label is the variable label with the string "_label" appended to the end. | |

| *FUNCTION* | **mainwindow_create** | |
|---|---|---|
| *PURPOSE* | Creates main window widgets | |
| *SYNTAX* | `static int mainwindow_create(MainwindowInfo instance, Widget parent);` | |
| | `MainwindowInfo instance;` | Main window information structure |
| | `Widget parent;` | parent widget |

| *FUNCTION* | MainwindowInfo_Clear | |
|---|---|---|
| *PURPOSE* | Clear all information in variable instance | |
| *SYNTAX* | `int MainwindowInfo_Clear(MainwindowInfo instance);` | |
| | `MainwindowInfo instance` | Main window information structure |

| FUNCTION | menubutton_create | |
|---|---|---|
| PURPOSE | Creates a pull down menu widget | |
| SYNTAX | `static int menubutton_create(MainwindowInfo instance, Widget parent, int Nx, int Ny);` | |
| | `MainwindowInfo instance;` | Main window information structure |
| | `Widget parent;` | Parent widget |
| | `int Nx;` | X position of widget |
| | `int Ny;` | Y position of widget |

| FUNCTION | menubutton_menu_create | |
|---|---|---|
| PURPOSE | `Creates the menu in a pull down menu widget` | |
| SYNTAX | `static int menubutton_menu_create(MainwindowInfo instance, Widget parent, ActDataPtr adp);` | |
| | `MainwindowInfo instance;` | Main window information structure |
| | `Widget parent;` | Parent widget |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| DESCRIPTION | The elements of the menu is a list of the valid actuator channels | |

| FUNCTION | MW_mainwindow_initialise | |
|---|---|---|
| PURPOSE | Initialise and create the main window | |
| SYNTAX | `int MW_mainwindow_initialise(MainwindowInfo instance, Widget parent, ActDataPtr adp);` | |
| | `MainwindowInfo instance;` | Main window information structure |
| | `Widget parent;` | parent widget |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Requires X-windows libraries | |

| FUNCTION | MW_target_create | |
|---|---|---|
| PURPOSE | Create the target angle widget in the main window | |
| SYNTAX | `static int MW_target_create(MainwindowInfo instance, Widget parent, char *label, int i, int j);` | |
| | `MainwindowInfo instance;` | Main window information structure |
| | `Widget parent;` | parent widget |
| | `char *label;` | Widget label |
| | `int i;` | Actuator channel number |
| | `int j;` | Position number |
| DESCRIPTION | Create a RowColumn widget consisting of a label widget and an editable Text widget. The X position of the widget is defined using XmATTACH_OPPOSITE_FORM and a right offset of -130. The Y position of the widget is based on the variable j | |

| FUNCTION | **panedwin_create** | |
|---|---|---|
| PURPOSE | Creates paned window widget | |
| SYNTAX | `Widget panedwin_create(Widget parent, char *Label);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | Paned window label |
| RETURN VALUES | Paned window widget | |

| FUNCTION | **secondwindow_create** | |
|---|---|---|
| PURPOSE | Creates calibration window widgets | |
| SYNTAX | `int secondwindow_create(SecondwindowInfo instance, Widget parent);` | |
| | `SecondwindowInfo instance;` | Second window information structure |
| | `Widget parent;` | parent widget |

| FUNCTION | Secondwindow_init | |
|---|---|---|
| PURPOSE | Initialise and create the main window | |
| SYNTAX | `int Secondwindow_init(SecondwindowInfo instance, Widget parent, ActDataPtr adp);` | |
| | `SecondwindowInfo instance;` | Second window information structure |
| | `Widget parent;` | parent widget |
| | `ActDataPtr adp;` | Pointer to actuator data structure |
| INCLUDES | `#include "actuator_ui.h"` | |
| DESCRIPTION | Requires X-windows libraries | |

| FUNCTION | SecondwindowInfo_Clear | |
|---|---|---|
| PURPOSE | Clear all information in variable instance | |
| SYNTAX | `int SecondwindowInfo_Clear(SecondwindowInfo instance);` | |
| | `SecondwindowInfo instance` | Calibration window information structure |

| FUNCTION | TextBox_create | |
|---|---|---|
| PURPOSE | Creates an editable text box widget | |
| SYNTAX | `Widget TextBox2_create(Widget parent, char *label, int Nx, int Ny);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | The string to be written |
| | `int Nx;` | X position of widget |
| | `int Ny;` | Y position of widget |
| RETURN VALUES | Text box widget | |
| DESCRIPTION | The length of the text box is 8 characters. This text box is not editable | |

| FUNCTION | TextBox2_create | |
|---|---|---|
| PURPOSE | Creates a text box widget | |
| SYNTAX | `Widget TextBox_create(Widget parent, char *label, int Nx, int Ny);` | |
| | `Widget parent;` | parent widget |
| | `char *label;` | The string to be written |
| | `int Nx;` | X position of widget |
| | `int Ny;` | Y position of widget |
| RETURN VALUES | Text box widget | |
| DESCRIPTION | The length of the text box is 8 characters. This text box is editable | |

| FUNCTION | Spline | |
|---|---|---|
| PURPOSE | Initialise cubic spline (calculate the second derivative for the tabulated data) | |
| SYNTAX | `void spline(double x[], double y[], int n, double yp1, double ypn, double y2[]);` | |
| | `double x[], y[];` | Tabulated array to interpolate |
| | `int n;` | number of elements in tabulated array |
| | `double yp1;` | first derivative at point 1 |
| | `double ypn;` | first derivative at point n |
| | `double y2[];` | Tabulated second derivative |
| INCLUDE | `#include "cub_spline.h"` | |
| DESCRIPTION | This function is obtained from the book "Numerical Recipes in C". If yp1 and/or ypn are equal to 1 x 1030 or larger, the routine is signalled to set the corresponding boundary condition for a natural spline, with a zero second derivative on that boundary. | |

| *FUNCTION* | **splint** | |
|---|---|---|
| *PURPOSE* | Initialise cubic spline (calculate the second derivative for the tabulated data) | |
| *SYNTAX* | `void spline(double xa[], double ya[], double y2a[], int n, double x, double *y);` | |
| | `double xa[], ya[];` | Tabulated array to interpolate |
| | `double y2a[];` | Tabulated second derivative (Calculated using function spline) |
| | `int n;` | Number of elements in array |
| | `double x` | Point at which to interpolate |
| | `double *y;` | Interpolated value |
| *INCLUDE* | `#include "cub_spline.h"` | |
| *DESCRIPTION* | This function is obtained from the book "Numerical Recipes in C". | |

# Appendix F: UDP Communication Software Functions

## F.1. UDP Communication Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| clsLSWT_ModuleBcastDataBase | Shuts down the "Bcast" library code in an orderly fashion. | rdDataLib.c |
| getBcastDataStructurePointer | Provides fleeting but unfettered read access to all aspects of the latest Bcast packet captured for a given module. | rdDataLib.c |
| getRdBcastDataVerboseFlag | Allows the state of the verbose flag to be determined. | rdDataLib.c |
| opnLSWT_ModuleBcastDataBase | Initialises the "Bcast" library code so that broadcast data can be accessed on Bernoulli. | rdDataLib.c |
| rdAllLSWT_ModulesBcastPacketStats | Provides all statistics on Bcast packets with one function call. | rdDataLib.c |
| rdAllLSWT_ModulesBcastPacketCaptureCount | Provides latest Bcast packet capture count for all modules. | rdDataLib.c |
| rdAllLSWT_ModulesBcastPacketLossCount | Provides latest Bcast packet loss count for all modules. | rdDataLib.c |
| rdLSWT_ModuleBcastHeaderSequenceNumber | Provides latest Bcast header sequence number for a given module. | rdDataLib.c |
| rdLSWT_ModuleBcastPacketCaptureCount | Provides latest Bcast packet capture count for a given module. | rdDataLib.c |

| | | |
|---|---|---|
| **rdLSWT_ModuleBcastPacketLossCount** | Provides latest Bcast packet loss count for a given module. | rdDataLib.c |
| **rdLSWT_ModuleBcastStrings** | Provides latest Bcast message strings for a given module. | rdDataLib.c |
| **rdLSWT_ModuleBcastUnsignedShortInts** | Provides latest Bcast data for a given module. | rdDataLib.c |
| **rdLSWT_ModuleData** | Provides latest Bcast data for a given module plus the packet count and loss statistics and the sequence number associated with that latest data. | rdDataLib.c |
| **rdTotalLSWT_BcastPacketCaptureCount** | Allows data transfer rate checking. | rdDataLib.c |
| **setRdBcastDataVerboseFlag** | Allows the state of the verbose flag to be changed at some point after initialisation of the library code. | rdDataLib.c |

## F.2. UDP Communication Software Function Summaries

| *FUNCTION* | **clsLSWT_ModuleBcastDataBase** |
|---|---|
| *PURPOSE* | Shuts down the "Bcast" library code in an orderly fashion. |
| *SYNTAX* | `int clsLSWT_ModuleBcastDataBase ( void )` |
| *INCLUDES* | `#include rdDataLib.h` |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful close operation. |
| *DESCRIPTION* | This function is the Bcast data access shut down routine. It closes access to the shared memory containing data sent from the LSWT modules via UDP packets to the testBcast daemon. The code checks that the global flag indicating that a previous open (see previously "opnLSWT_ModuleBcastDataBase()" ) was successful and if it was then it detaches the two Bcast shared memory areas from the program calling this close routine. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it sets a global flag indicating that the Bcast module read data routines cannot be used and returns a non-zero value. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>... Read data ...<br>if ( ! clsLSWT_ModuleBcastDataBase()) fprintf ( stderr, "Close Failed\n" );<br>... Do other clean ups and closures ...<br>} |

| *FUNCTION* | **getBcastDataStructurePointer** | |
|---|---|---|
| *PURPOSE* | Provides fleeting but unfettered read access to all aspects of the latest Bcast packet captured for a given module. | |
| *SYNTAX* | `struct LSWT_UDP_INFO * getBcastDataStructurePointer ( int moduleID )` | |
| | `int moduleID;` | An integer that specifies the module[2]. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns a NULL pointer if an error occurs, otherwise a pointer to the data structure is returned. | |
| *DESCRIPTION* | This low-level function makes possible read access to the latest Bcast packet captured for a given module. This function checks that the specified module is valid and then checks that data exists for the specified module and if so it then returns a pointer to that data to the calling program. There is no check to see that the open function has been called and this function does not guarantee that data pointed at will remain either static or up to date. Indeed the data accessed via this pointer is likely to become stale very quickly and be overwritten by a data packet from any module shortly after it becomes stale. If there is an invalid module specified or there is no data available then an error message is output and the return pointer is set to NULL. | |

[2] Freestream Parameters Module = 1
Paramater Display Module = 2
Auxiliary Data Module = 3
Sting Column Rig Module = 4
Serial Hub Module = 5
AC Strain Gauge 1 Module = 7
AC Strain Gauge 2 Module = 8
DC Strain Gauge 1 Module = 9
DC Strain Gauge 2 Module = 10
Inclinometer Module = 11
Model Attitude Module = 12
Actuator Module = 13
Balance Calibration Module = 14

| | |
|---|---|
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>struct LSWT_UDP_INFO * ptr;<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>ptr = getBcastDataStructurePointer ( 12 );<br>if ( ptr == NULL )<br>fprintf ( stderr, "Unable to get pointer to module 12 data\n" );<br>else {<br>printf ( "Module 12 latest packet sequence field is %x\n",<br>ptr-sequenceNumber );<br>printf ( "Module 12 latest packet time field is %d\n",<br>( int ) ptr-timeSinceMidnightInMilliseconds );<br>}<br>} |

| *FUNCTION* | **getRdBcastDataVerboseFlag** |
|---|---|
| *PURPOSE* | Allows the state of the verbose flag to be determined. |
| *SYNTAX* | `int getRdBcastDataVerboseFlag ( void );` |
| *INCLUDES* | `#include rdDataLib.h` |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False or Off) when the verbose flag is false, otherwise a non-zero is returned indicating the flag is True or On. |
| *DESCRIPTION* | This function returns the state of the Bcast data library global verbose text output flag. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>printf ( "Verbose Flag is %s\n", ( getRdBcastDataVerboseFlag () ? "On" : "Off" ));<br>... Other statements ... |

| *FUNCTION* | **opnLSWT_ModuleBcastDataBase** | |
|---|---|---|
| *PURPOSE* | Initialises the "Bcast" library code so that broadcast data can be accessed on Bernoulli. | |
| *SYNTAX* | `int opnLSWT_ModuleBcastDataBase ( int verboseFlag );` | |
| | `int verboseFlag;` | Used to set a global flag to indicate if verbose message output is required. If it is set to zero then error messages are the only text output from this and other Bcast data access functions. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful open operation. | |
| *DESCRIPTION* | This function is the Bcast data access initialisation routine. It opens access to the shared memory containing data sent from LSWT modules via UDP packets to the testBcast daemon. The code copies the "verboseFlag" parameter to a global flag variable then attaches the two Bcast shared memory areas and the Bcast semaphore to the program calling this open routine. If the verbose flag is on and the function is successful then the pointer values to the shared memory are printed out. If a shared memory cannot be attached or the semaphore is not available then an error message is output and the return value is set to zero. If the code is successful then it sets a global flag indicating that the other Bcast module data routines can be used and returns a non-zero value. | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int flag = 1;<br>... Do other initialisation ...<br>if ( ! opnLSWT_ModuleBcastDataBase( flag )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>... Read data ...<br>if ( ! clsLSWT_ModuleBcastDataBase()) fprintf ( stderr, "Close Failed\n" );<br>... Do other clean ups and closures ...<br>} | |

| *FUNCTION* | **rdAllLSWT_ModulesBcastPacketStats** | |
|---|---|---|
| *PURPOSE* | Provides all statistics on Bcast packets with one function call. | |
| *SYNTAX* | `int rdAllLSWT_ModulesBcastPacketStats ( unsigned int * countPtr, unsigned int * lossPtr)` | |
| | `unsigned int * countPtr;` | Pointer to an array into which to put the unsigned integer packet capture count data for each module. An array size defined by LSWT_DUMMY_FOR_LAST_MODULE is expected. This pointer must not be a NULL pointer. |
| | `Unsigned int * lossPtr;` | Pointer to an array into which to put the unsigned integer packet loss data for each module. An array size defined by LSWT_DUMMY_FOR_LAST_MODULE is expected. This pointer must not be a NULL pointer. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to both the packet capture count and packet loss count statistics for all individual modules plus the total for all modules combined. This function checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some point in the past and if so it copies the latest available unsigned short integer statistics data from the shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |

| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int cnt;<br>unsigned int cntBfr[ LSWT_DUMMY_FOR_LAST_MODULE ];<br>unsigned int lossBfr[ LSWT_DUMMY_FOR_LAST_MODULE ];<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdAllLSWT_ModulesBcastPacketStats ( cntBfr, lossBfr ))<br>  fprintf ( stderr, "Unable to Read All Modules Packet Statistics\n" );<br>  else {<br>  printf ( "Total Bcast Packets captured is %u, and lost is %u\n",<br>  cntBfr[ 0 ], lossBfr[ 0 ] );<br>  for( cnt = 1; cnt < LSWT_DUMMY_FOR_LAST_MODULE; cnt++ )<br>  printf ( "Module %d - %u captured %u lost\n",<br>  cnt, cntBfr[ cnt ], lossBfr[ cnt] );<br>  }<br>} |
|---|---|

| *FUNCTION* | **rdAllLSWT_ModulesBcastPacketCaptureCount** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast packet capture count for all modules. | |
| *SYNTAX* | `int rdAllLSWT_ModulesBcastPacketCaptureCount ( unsigned int * countArrayPtr )` | |
| | `unsigned int * countArrayPtr;` | Pointer to an array of unsigned integers into which to copy all the latest packet capture counts. An array size defined by LSWT_DUMMY_FOR_LAST_MODULE is expected. This pointer must not be a NULL pointer. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to the latest Bcast packet capture counts for all modules. This function checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some point in the past and if so it copies the unsigned integer packet capture count array from the shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int cnt;<br>unsigned int counts[ LSWT_DUMMY_FOR_LAST_MODULE ];<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdAllLSWT_ModulesBcastPacketCaptureCount ( counts ))<br>  fprintf ( stderr, "Unable to Read all packet capture counts\n" );<br>  else {<br>  printf ( "The total packets captured is %u\n", counts[ 0 ] );<br>  for ( cnt =1; cnt < LSWT_DUMMY_FOR_LAST_MODULE; cnt++ )<br>  printf( "%u packets captured from module %d\n, counts[ cnt ], cnt );<br>  }<br>} | |

| FUNCTION | rdAllLSWT_ModulesBcastPacketLossCount | |
|---|---|---|
| PURPOSE | Provides latest Bcast packet loss count for all modules. | |
| SYNTAX | `int rdAllLSWT_ModulesBcastPacketLossCount ( unsigned int * lossArrayPtr )` | |
| | `unsigned int * lossArrayPtr;` | Pointer to an array of unsigned integers into which to copy all the latest packet loss counts. An array size defined by LSWT_DUMMY_FOR_LAST_MODULE is expected. This pointer must not be a NULL pointer. |
| INCLUDES | `#include rdDataLib.h` | |
| RETURN VALUES | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| DESCRIPTION | This function gives access to the latest Bcast packet loss counts for all modules. This function checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some point in the past and if so it copies the unsigned integer packet loss count array from the shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| USEAGE | #include "rdDataLib.h"<br>... Other includes ...<br>int cnt;<br>unsigned int lossCnts[ LSWT_DUMMY_FOR_LAST_MODULE ];<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdAllLSWT_ModulesBcastPacketLossCount ( lossCnts ))<br>  fprintf ( stderr, "Unable to Read all packet loss counts\n" );<br>  else {<br>  printf ( "The total packet loss count is %u\n", lossCnts[ 0 ] );<br>  for ( cnt =1; cnt < LSWT_DUMMY_FOR_LAST_MODULE; cnt++ )<br>  printf( "%u packets lost from module %d\n, lossCnts[ cnt ], cnt );<br>  }<br>} | |

| *FUNCTION* | **rdLSWT_ModuleBcastHeaderSequenceNumber** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast header sequence number for a given module. | |
| *SYNTAX* | `int rdLSWT_ModuleBcastHeaderSequenceNumber ( int module, unsigned short int * sequencePtr )` | |
| | `int module;` | The integer identifier of the module that data is required from. |
| | `Unsigned short int * sequencePtr;` | Pointer to an unsigned short integer into which to copy the sequence number from the latest packet header. It must not be a NULL pointer. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to the latest Bcast packet header sequence from a particular module. This function first checks that the module number is valid, then it checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some time in the past and finally it checks that data is available for the specified module. If these conditions are met then it copies the unsigned short integer sequence value for the specified module from the shared memory to the calling programs memory. If the checks mentioned fail then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int mod = 7;<br>unsigned short int seqNum;<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleBcastHeaderSequenceNumber ( mod, &seqNum ))<br>  fprintf ( stderr, "Unable to Read Module %d sequence number\n", mod );<br>  else {<br>  printf ( "Module %d sequence number is %x\n", mod, seqNum );<br>  }<br>} | |

| *FUNCTION* | **rdLSWT_ModuleBcastPacketCaptureCount** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast packet capture count for a given module. | |
| *SYNTAX* | `int rdLSWT_ModuleBcastPacketCaptureCount ( int module, unsigned int * countPtr )` | |
| | `Int module;` | The integer identifier of the module that the capture count is required for. |
| | `Unsigned int * countPtr;` | A Pointer to an unsigned integer into which to copy the module's latest packet capture count. It must not be a NULL pointer. |
| *INCLUDES* | `#include RdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to the latest Bcast packet capture count from a particular module. This function checks that the module number is valid and that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some point in the past and if so it copies the unsigned integer packet capture count for the specified module from the shared memory to the calling programs memory. If there has not been a previous successful open or the module value is invalid then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int mod =3;<br>unsigned int count;<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleBcastPacketCaptureCount ( mod, &count ))<br>  fprintf ( stderr, "Unable to Read Module %d packet capture count\n", mod );<br>  else {<br>  printf ( "%u packets received from module %d \n", count, mod );<br>  }<br>} | |

| FUNCTION | rdLSWT_ModuleBcastPacketLossCount | |
|---|---|---|
| PURPOSE | Provides latest Bcast packet loss count for a given module. | |
| SYNTAX | `int rdLSWT_ModuleBcastPacketLossCount ( int module, unsigned int * lossCntPtr )` | |
| | `int module;` | The integer identifier of the module that the loss count is required for. |
| | `unsigned int * lossCntPtr;` | A Pointer to an unsigned integer into which to copy the module's latest packet loss count. It must not be a NULL pointer. |
| INCLUDES | `#include rdDataLib.h` | |
| RETURN VALUES | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| DESCRIPTION | This function gives access to the latest Bcast packet loss count from a particular module. This function first checks that the module number is valid and that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some point in the past and if so it copies the unsigned integer packet loss count for the specified module from the shared memory to the calling programs memory. If there has not been a previous successful open or the module value is invalid then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| USEAGE | #include "rdDataLib.h"<br>... Other includes ...<br>int mod =11;<br>unsigned int lossCnt;<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleBcastPacketLossCount ( mod, &lossCnt ))<br>  fprintf ( stderr, "Unable to Read Module %d packet loss count\n", mod );<br>  else {<br>  printf ( "Module %d packet loss count is %u\n", mod, lossCnt );<br>  }<br>} | |

| *FUNCTION* | **rdLSWT_ModuleBcastStrings** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast message strings for a given module. | |
| *SYNTAX* | `int rdLSWT_ModuleBcastStrings ( int module, int vector, char * stringBuffer, int bufferSize )` | |
| | `int module;` | The integer identifier of the module that data is required from. |
| | `int vector;` | The integer vector number that selects the required message string. |
| | `char * stringBuffer;` | Pointer to a target buffer into which to put the message string. It must not be a NULL pointer. |
| | `int bufferSize;` | The integer that is the size of the buffer that the message string will be placed in. This integer should be greater than zero. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to Bcast message strings from a particular module. This function first checks that the module number is valid and that the vector specifies a read, then it checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some time in the past, then it checks that the buffer size is greater than zero, then it checks that vector 0x62 has been specified and finally it checks that data is available for the specified module. If all these conditions are met then it copies the latest available character string for the specified module from the shared memory to the calling programs memory. The number of characters copied is the smaller of the actual string length and the size of the buffer available to store the string, represented by bufferSize. Currently only one string is available in shared memory and this is the module identification string ( vector 0x62 ). If any of the checks mentioned fail then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |

| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int mod = 1, vec = 0x62;<br>char str[ 16 ];<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleBcastStrings ( mod, vec, str, sizeof( str )))<br>  fprintf ( stderr, "Unable to Read Module ID string\n" );<br>  else {<br>  printf ( "Module ID string is '%s'\n", str );<br>  }<br>} |
|---|---|

| *FUNCTION* | **rdLSWT_ModuleBcastUnsignedShortInts** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast data for a given module. | |
| *SYNTAX* | `int rdLSWT_ModuleBcastUnsignedShortInts ( int module, int vector, unsigned short int * dataBffr, int * valuesInBffrPtr)` | |
| | `int module;` | The integer identifier of the module that data is required from. |
| | `Int vector;` | The integer vector number that selects the start of the required subset of data. |
| | `Unsigned short int * dataBffr;` | Pointer to a target buffer into which to put the unsigned short integer data. It must not be a NULL pointer. |
| | `Int * valuesInBffrPtr;` | Pointer to an integer that is the desired number of unsigned short integer data values to copy on entry and on exit is the actual number of data values in the data buffer. This pointer must not be a NULL pointer and the integer it points to on entry must be greater than zero. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESC.* | This function gives access to a subset of the Bcast data from a particular module. This function first checks that the module number is valid and that the vector specifies a read, then it checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some time in the past, then it checks that the number of values to copy is greater than zero, then it checks that the vector number is valid and finally it checks that data is available for the specified module. If all these conditions are met then it copies the latest available unsigned short integer data values for the specified module from the shared memory to the calling programs memory. The number of data values copied is the smaller of the desired value pointed at by valuesInBffrPtr and the available data values including and following the vector number. The value pointed at by valuesInBffrPtr is updated to reflect the actual number of unsigned short integer values copied out of shared memory. If any of the checks mentioned fail then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |

| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int cnt, dataCnt = 16;<br>int mod = 1, vec = 0x80;<br>unsigned short int dataBfr[ 16 ];<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleBcastUnsignedShortInts ( mod, vec, dataBfr, &dataCnt ))<br>  fprintf ( stderr, "Unable to Read Unsigned Integer Data\n" );<br>  else {<br>  for( cnt = 0; cnt < dataCnt; cnt++ ) printf ( "%x\n", dataBfr[ cnt ] );<br>  }<br>} |
|---|---|

| *FUNCTION* | **rdLSWT_ModuleData** | |
|---|---|---|
| *PURPOSE* | Provides latest Bcast data for a given module plus the packet count and loss statistics and the sequence number associated with that latest data. | |
| *SYNTAX* | `int rdLSWT_ModuleData ( int module, int vector, unsigned short int * dataBffr, int * valuesInBffrPtr, unsigned int * packetCaptureCountPtr, unsigned int * packetLossCountPtr, unsigned short int * packetSequenceNumPtr )` | |
| | `int module;` | The integer identifier of the module that data is required from. |
| | `int vector;` | The integer vector number that selects the required subset of data. |
| | `unsigned short int * dataBffr;` | Pointer to a target buffer into which to put the unsigned short integer data. It must not be a NULL pointer. |
| | `int * valuesInBffrPtr;` | Pointer to an integer that is the desired number of unsigned short integer data values to copy on entry and on exit is the actual number of data values in the data buffer. This pointer must not be a NULL pointer and the integer it points to on entry must be greater than zero. |
| | `unsigned int * packetCaptureCountPtr;` | Pointer to an unsigned integer that will be updated with the current packet capture count for the module. This pointer must not be a NULL pointer. |
| | `unsigned int * packetLossCountPtr;` | Pointer to an unsigned integer that will be updated with the current packet loss count for the module. This pointer must not be a NULL pointer. |
| | `unsigned short int * packetSequenceNumPtr;` | Pointer to an unsigned short integer that will be updated with the current packet sequence number for the module. This pointer must not be a NULL pointer. |
| *INCLUDES* | `#include rdDataLib.h` | |

| | |
|---|---|
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. |
| *DESCRIPTION* | This function gives access to a subset of the Bcast data plus additional information for a given module. This function first checks that the module number is valid and that the vector specifies a read, then it checks that there has been a successful open (see previously "opnLSWT_ModuleBcastDataBase()" ) at some time in the past, then it checks that the buffer size is greater than zero and finally it checks that data is available for the specified module. If all these conditions are met it copies the latest available unsigned short integer data values and additional information for the specified module from the shared memory to the calling programs memory. The number of data values copied is the smaller of the desired value pointed at by valuesInBffrPtr and the available data values including and following the vector number. The value pointed at by valuesInBffrPtr is updated to reflect the actual number of unsigned short integer values copied out of shared memory. If any of the checks fail then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int mod = 1, vec = 0xf0;<br>int dataCnt = 1;<br>unsigned short int dataBfr[ 4 ];<br>unsigned short int seq;<br>unsigned int rec, lost;<br>... Initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_ModuleData (mod, vec, dataBfr, &dataCnt, &rec, &lost, &seq ))<br>  fprintf ( stderr, "Unable to read module %d vector %x data\n", mod, vec );<br>  else {<br>  if ( dataCnt 0 )<br>  printf ( "Module %d, vector %d data is %x\n", mod, vec, dataBfr[ 0 ] );<br>  printf ( "%u packets have been captured for this module\n", rec );<br>  printf ( "%u packets have been lost from this module\n", lost );<br>  printf ( "The current module %d sequence number is %x\n", mod, seq );<br>  }<br>} |

| FUNCTION | rdTotalLSWT_BcastPacketCaptureCount | |
|---|---|---|
| PURPOSE | Allows data transfer rate checking. | |
| SYNTAX | `int rdTotalLSWT_BcastPacketCaptureCount ( unsigned int * countPtr)` | |
| | `unsigned int * countPtr;` | Pointer to an unsigned integer into which to put the current total number of packets processed by the testBcast daemon. It must not be a NULL pointer. |
| INCLUDES | `#include rdDataLib.h` | |
| RETURN VALUES | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| DESCRIPTION | This function gives access to the latest Bcast total packet count. The total packet count is incremented by one each time a packet from any module is written to shared memory. This function checks that there has been a successful open ( see previously "opnLSWT_ModuleBcastDataBase()" ) at some time in the past and if so it then copies the total packet count from shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| USEAGE | #include "rdDataLib.h"<br>... Other includes ...<br>unsigned int cnt;<br>... initialize other variables ...<br>if ( ! opnLSWT_ModuleBcastDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdTotalLSWT_BcastPacketCaptureCount ( &cnt))<br>  fprintf ( stderr, "Unable to get Total Packet Capture Count\n" );<br>  else {<br>  printf( "%u Packets captured so far!\n", cnt );<br>  }<br>} | |

| *FUNCTION* | **setRdBcastDataVerboseFlag** | |
|---|---|---|
| *PURPOSE* | Allows the state of the verbose flag to be changed at some point after initialisation of the library code. | |
| *SYNTAX* | `void setRdBcastDataVerboseFlag ( int flag );` | |
| | `int flag;` | Used to set the global verbose flag to indicate if verbose message output is required. If it is set to zero then error messages are the only text output from this and other Bcast data access functions. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | None. | |
| *DESCRIPTION* | This function sets the state of the Bcast data library verbose text output flag. The code sets the global verbose text output flag equal to the result of comparing the flag parameter as not equal with false (ie. Zero ). | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int flag = 1;<br>... Do other initialization ...<br>if ( ! opnLSWT_ModuleDataBase( flag )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  flag = 0;<br>  setRdBcastDataVerboseFlag( flag );<br>  ... Read Data (without any verbose messages) ...<br>} | |

# Appendix G: VXI Communication Software Functions

## G.1. VXI Communication Software Function Index

| FUNCTION | DESCRIPTION | FILE |
|---|---|---|
| clsLSWT_VxiModuleDataBase | Shuts down the VXI library code in an orderly fashion. | rdDataLib.c |
| getVxiDataLibVerboseFlag | Allows the state of the verbose flag to be determined. | rdDataLib.c |
| opnLSWT_VxiModuleDataBase | Initialises the VXI library code so that VXI data can be accessed on the LSWT host computer Bernoulli. | rdDataLib.c |
| rdLSWT_VxiDataLinesProcessed | Allows data transfer rate checking. | rdDataLib.c |
| rdLSWT_VxiModuleData | Allow access to latest VXI data plus the time stamp and total number of data values associated with that latest data. | rdDataLib.c |
| rdLSWT_VxiModuleDoubles | Allow access to latest VXI data. | rdDataLib.c |
| setVxiDataLibVerboseFlag | Allows the state of the verbose flag to be changed at some point after initialisation of the library code. | rdDataLib.c |

## G.2. VXI Communication Software Function Summaries

| *FUNCTION* | **clsLSWT_VxiModuleDataBase** |
|---|---|
| *PURPOSE* | Shuts down the VXI library code in an orderly fashion. |
| *SYNTAX* | `int clsLSWT_VxiModuleDataBase ( void )` |
| *INCLUDES* | `#include rdDataLib.h` |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful close operation. |
| *DESCRIPTION* | This function is the VXI data access shut down routine. It closes access to the shared memory containing data sent from the VXI module through HP Vee and the vxiDataD daemon. The code checks that the global flag indicating that a previous open (see previously "opnLSWT_VxiModuleDataBase()" ) was successful and if it was then it detaches the two VXI shared memory areas from the program calling this close routine. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it sets a global flag indicating that the VXI module read data routines cannot be used and returns a non-zero value. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>if ( ! opnLSWT_VxiModuleDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>... Read data ...<br>if ( ! clsLSWT_VxiModuleDataBase()) fprintf ( stderr, "Close Failed\n" );<br>... Do other clean ups and closures ...<br>} |

| *FUNCTION* | **getVxiDataLibVerboseFlag** |
|---|---|
| *PURPOSE* | Allows the state of the verbose flag to be determined. |
| *SYNTAX* | `int getVxiDataLibVerboseFlag ( void );` |
| *INCLUDES* | `#include rdDataLib.h` |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False or Off) when the verbose flag is false, otherwise a non-zero is returned indicating the flag is True or On. |
| *DESCRIPTION* | This function returns the state of the VXI data library global verbose text output flag. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>printf ( "Verbose Flag is %s\n", ( getVxiDataLibVerboseFlag () ? "On" : "Off" ));<br>... Other statements ... |

| FUNCTION | opnLSWT_VxiModuleDataBase | |
|---|---|---|
| PURPOSE | Initialises the VXI library code so that VXI data can be accessed on Bernoulli. | |
| SYNTAX | `int opnLSWT_VxiModuleDataBase ( int verboseFlag );` | |
| | `int verboseFlag;` | Used to set a global flag to indicate if verbose message output is required. If it is set to zero then error messages are the only text output from this and other VXI data access functions. |
| INCLUDES | `#include rdDataLib.h` | |
| RETURN VALUES | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful open operation. | |
| DESCRIPTION | This function is the VXI data access initialisation routine. It opens access to the shared memory containing data sent from the VXI module through HP Vee and the vxiDataD daemon. The code copies the "verboseFlag" parameter to a global flag variable then attaches the two VXI shared memory areas and the VXI semaphore to the program calling this open routine. If a shared memory cannot be attached or the semaphore is not available then an error message is output and the return value is set to zero. If the code is successful then it sets a global flag indicating that the other VXI module data routines can be used and returns a non-zero value. | |
| USEAGE | #include "rdDataLib.h"<br>... Other includes ...<br>int flag = 1;<br>... Do other initialisation ...<br>if ( ! opnLSWT_VxiModuleDataBase( flag )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>... Read data ...<br>if ( ! clsLSWT_VxiModuleDataBase()) fprintf ( stderr, "Close Failed\n" );<br>... Do other clean ups and closures ...<br>} | |
| FUNCTION | rdLSWT_VxiDataLinesProcessed | |
| PURPOSE | Allows data transfer rate checking. | |
| SYNTAX | `int rdLSWT_VxiDataLinesProcessed ( unsigned long int * countPtr)` | |
| | `Unsigned long int *countPtr;` | Pointer to an unsigned long integer into which to put the current number of data lines processed by the vxiDataD daemon. It must not be a NULL pointer. |

| | |
|---|---|
| *INCLUDES* | `#include rdDataLib.h` |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. |
| *DESCRIPTION* | This function gives access to the VXI data line count. The data line count is incremented by one each time a complete line of numbers from HP Vee is converted to an array of double in shared memory. This count parallels the packet count in a UDP based data transfer system. This function first checks that there has been a successful open (see previously "opnLSWT_VxiModuleDataBase()" ) and if so it then copies the data line count from shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>unsigned long int cnt, oldCnt;<br>... initialize other variables ...<br>if ( ! opnLSWT_VxiModuleDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_VxiDataLinesProcessed ( &cnt))<br>  fprintf ( stderr, "Unable to Read Data Line Count\n" );<br>  else {<br>  oldCnt = cnt;<br>  do { rdLSWT_VxiDataLinesProcessed ( &cnt ); } while ( cnt == oldCnt );<br>  ... Read up to date data ...<br>  }<br>} |

| FUNCTION | rdLSWT_VxiModuleData | |
|---|---|---|
| PURPOSE | Allow access to latest VXI data plus the time stamp and total number of data values associated with that latest data. | |
| SYNTAX | `int rdLSWT_VxiModuleData ( double * dataBffr, int * valuesInBffrPtr, int * totalNumberAvlblPtr, struct timeval * timeStmpPtr )` | |
| | `Double *dataBffr;` | Pointer to a target buffer into which to put the double length floating point VXI data. This pointer must not be a NULL pointer. |
| | `int *valuesInBffrPtr;` | Pointer to an integer that is the desired number of VXI data values to copy on entry and on exit is the actual number of VXI data values in the data buffer. This pointer must not be a NULL pointer and the integer it points to on entry must be greater than zero. |
| | `int *totalNumberAvlblPtr;` | Pointer to an integer that is set to the total number of VXI data values in the shared memory data buffer on exit. This pointer may be a NULL pointer and if it is then this parameter is ignored. |
| | `Struct timeval * timeStmpPtr;` | Pointer to a target buffer into which to put the time stamp associated with the VXI data values. This pointer may be a NULL pointer and if it is then this parameter is ignored. |
| INCLUDES | `#include lswtGlbl.h`<br>`#include rdDataLib.h` | |
| RETURN VALUES | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| DESCRIPTION | This function gives access to the VXI data plus additional information. It copies the latest available double length floating point data values plus time stamp and total number of available data values from the shared memory that is updated by the `vxiDataD` daemon. This function first checks that there has been a successful open (see previously "`opnLSWT_VxiModuleDataBase()`") and if so it copies the data and additional information from the shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the | |

| | |
|---|---|
| | return value is set to zero. If the code is successful then it returns a non-zero value. |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int totalCnt, dataCount = 1;<br>double dataBuffer[ 4 ];<br>struct timeval tmStamp;<br>... Initialize other variables ...<br>if ( ! opnLSWT_VxiModuleDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>  if ( ! rdLSWT_VxiModuleData ( dataBuffer, &dataCnt, &totalCnt, &tmStamp ))<br>  fprintf ( stderr, "Unable to Read Data\n" );<br>  else {<br>  printf ( "There are %d data values available, ", totalCnt );<br>  printf ( "the first is %lf\n", dataBuffer[ 0 ] );<br>  printf ( "The data was placed in shared mem at %d sec\n", tmStamp.tv_sec );<br>  }<br>} |

| *FUNCTION* | **rdLSWT_VxiModuleDoubles** | |
|---|---|---|
| *PURPOSE* | Allow access to latest VXI data. | |
| *SYNTAX* | `int rdLSWT_VxiModuleDoubles ( double * dataBffr, int * valuesInBffrPtr)` | |
| | `double *dataBffr;` | Pointer to a target buffer into which to put the double length floating point VXI data. It must not be a NULL pointer. |
| | `Int *valuesInBffrPtr;` | Pointer to an integer that is the desired number of VXI data values to copy on entry and on exit is the actual number of VXI data values in the data buffer. This pointer must not be a NULL pointer and the integer it points to on entry must be greater than zero. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | Returns an integer value of 0 (ie. Zero or False) if an error occurs, otherwise a non-zero is returned indicating a successful read operation. | |
| *DESCRIPTION* | This function gives access to the VXI data. This function first checks that there has been a successful open (see previously "`opnLSWT_VxiModuleDataBase()`" ) and if so it copies the latest available double length floating point data values from the shared memory to the calling programs memory. If there has not been a previous successful open then an error message is output and the return value is set to zero. If the code is successful then it returns a non-zero value. | |
| *USEAGE* | `#include "rdDataLib.h"`<br>`... Other includes ...`<br>`int cnt, dataCount = 64;`<br>`double dataBuffer[ 64 ];`<br>`... initialize other variables ...`<br>`if ( ! opnLSWT_VxiModuleDataBase( 0 )) fprintf ( stderr, "Open Failed\n" );`<br>`else {`<br>`  if ( ! rdLSWT_VxiModuleDoubles ( dataBuffer, &dataCnt ))`<br>`  fprintf ( stderr, "Unable to Read Data\n" );`<br>`  else {`<br>`  for( cnt = 0; cnt < dataCount; cnt++ ) printf ( "%lf\n", dataBuffer[ cnt ] );`<br>`  }`<br>`}` | |

| *FUNCTION* | **setVxiDataLibVerboseFlag** | |
|---|---|---|
| *PURPOSE* | Allows the state of the verbose flag to be changed at some point after initialisation of the library code. | |
| *SYNTAX* | `void setVxiDataLibVerboseFlag ( int flag );` | |
| | `int flag;` | Used to set the global verbose flag to indicate if verbose message output is required. If it is set to zero then error messages are the only text output from this and other VXI data access functions. |
| *INCLUDES* | `#include rdDataLib.h` | |
| *RETURN VALUES* | None. | |
| *DESCRIPTION* | This function sets the state of the VXI data library verbose text output flag. The code sets the global verbose text output flag equal to the result of comparing the flag parameter with false (ie. zero ). | |
| *USEAGE* | #include "rdDataLib.h"<br>... Other includes ...<br>int flag = 1;<br>... Do other initialisation ...<br>if ( ! opnLSWT_VxiModuleDataBase( flag )) fprintf ( stderr, "Open Failed\n" );<br>else {<br>flag = 0;<br>setVxiDataLibVerboseFlag( flag );<br>... Read Data (without any verbose messages) ...<br>} | |

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19. ABSTRACT

The data acquisition system in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory was recently upgraded. Several software packages were developed using C, X/Motif, and OpenGL programming languages and libraries. The software provides wind tunnel operators with graphical user interfaces from which test data can be easily monitored, acquired and processed. Descriptions of all software source code functions have been compiled and included as Appendices in this document. These function summaries have also been published on the Defence Science and Technology Organisation Intranet for easy reference for future software development.